POPULAR SCIENCE

JANUARY · 35c Monthly

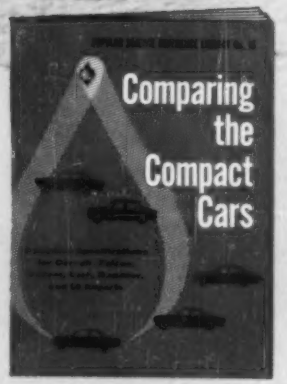
10,000 MILES IN A CORVAIR

Transcontinental Test of Small Rear-Engine Chevrolet

PAGE 112

Annual Auto Section

50 PAGES ON CARS
Plus All Regular Features



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As with each Progress Kit in the Program, a set of handy practice and application cards accompanies the memory handbook to help you "learn by doing." Slip them into the pocket case provided – for use in your spare moments. They've been scientifically planned to add a "real life" dimension to self-instruction.

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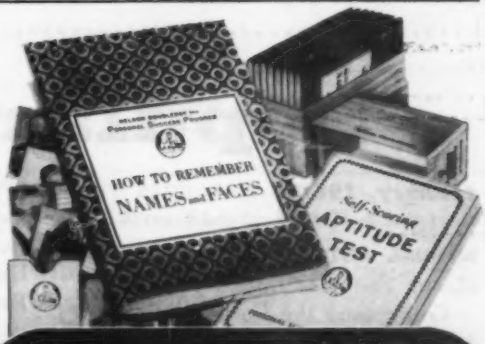

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After examining this package, I will let you know within ten days if I do not wish to continue with the Personal Success Program. If I do continue, you will send me a new Progress Kit each month and bill me only $1 each plus a few cents shipping. I am not obligated to take any minimum number of kits, and I am free to stop at any time.

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Cover photo by W. W. Morris and Robert D. Borst

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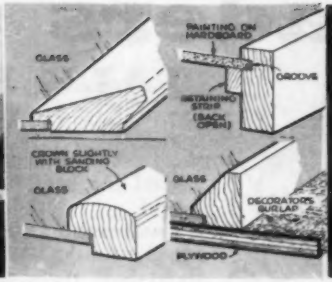

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Publisher EUGENE S. DUFFIELD **Advertising Manager** LEE P. ADAMS **Circulation Director** EUGENE WATSON

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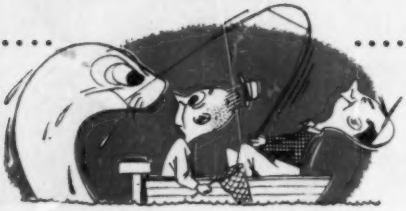
PS Readers

TALK BACK



Sea-Monster Skeptics Now Believe

I MUST admit I was skeptical before I read "Why I Believe in Sea Monsters" [Oct.] by marine biologist Dr. Anton F. Bruun. But now I'm inclined to believe in the existence of these giant eels.

Such science articles add much to the quality of your magazine and I hope you continue them.

N. KIBIGER, Grosse Pointe Woods, Mich.

. . . BACK in the 30s, a sea serpent was reported in Cadboro Bay, near here. Since then, Cadbosaurus (Caddy, for short) has been reported in various places around the southern end of Vancouver Island.

I was skeptical until last August when out in a fishing boat. Heading in to shore about 5:30 p.m., our party saw a commotion in the water about 75 feet away. A head rose above the surface about three feet. We judged it to be a foot in diameter. Above water level we could see about 10 feet of body, somewhat greater around than the head. The creature was traveling toward open sea at the 14 or 15 knots mentioned by Dr. Bruun.

It stayed above water, making a great wake as it surged along for perhaps 20 yards, then dived. We saw it surface again some distance away, but in seconds it had gone out into the strait of Juan de Fuca. Whatever it was, four grown people

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SHERMAN CURTIS, Seattle.

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No. 14. When Your Power Mower Conks Out
No. 15. Common Repairs for Electric Trains

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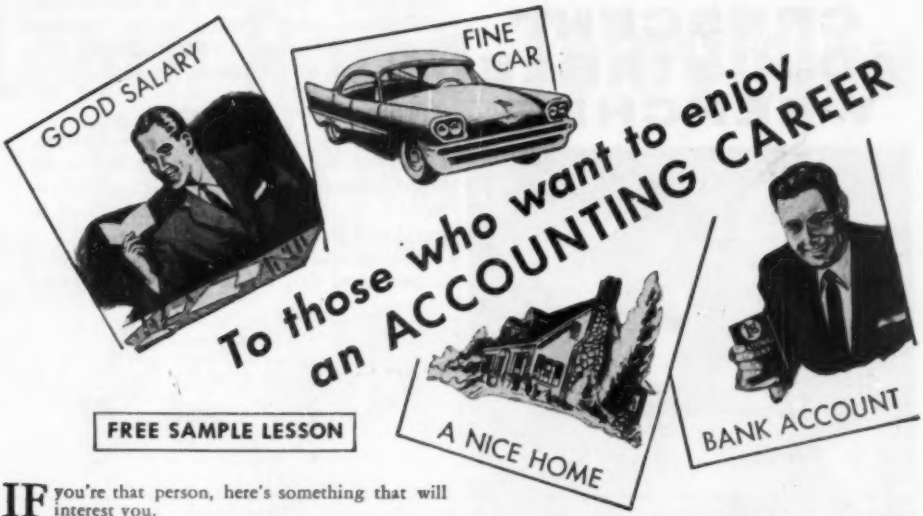

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Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

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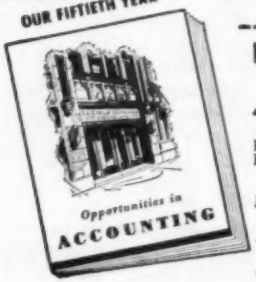

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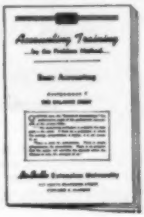

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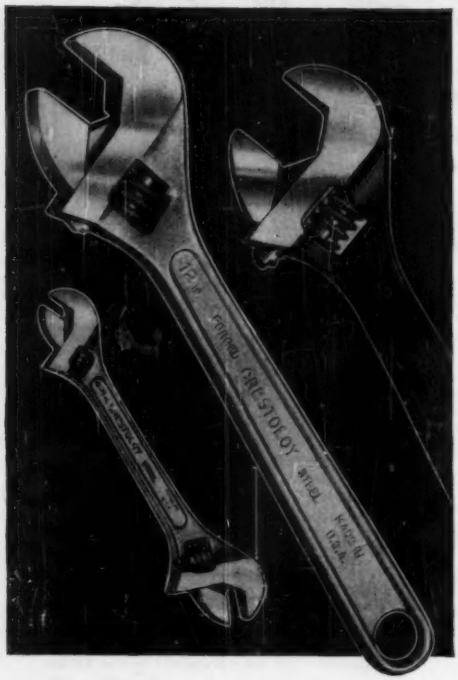

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had seen it. All agreed as to description, which was much similar to the drawing of the sea monster in your magazine.

J. F. CAMERON, Victoria, B. C.

Symphony from a Workshop

AN OLD house trailer is my workshop. I use the shop (as Santa Claus) to rebuild, refinish or repair musical instruments for children who cannot afford to purchase new ones.

The instruments are given to a public library and can be borrowed like books

—but for a long period of time. Some I rebuilt were nearly junk, some pretty good. If my trailer workshop can furnish enough repaired instruments, perhaps some juvenile "steam" will be turned to productive effort and fewer youngsters will need psychiatrists or land in police courts.

I believe the famous "Satchmo" got his start in an orphanage on an old donated cornet. This is an inspiration to me. Surely there never was a man could play so much horn.

T. C. QUAYLE, Veneta, Ore.

Old Principle Pops Up

THE use of alternating cylinders in automotive engines to save gas ["New Ideas from the Inventors," Oct.] is an interesting variation of an old principle.

Over 30 years ago, a farmer I knew used a water-pumping engine that had an intake valve opening only by atmospheric pressure. The exhaust valve was held open by the governor whenever speed exceeded a set limit, so that the engine inhaled only air, and no fuel, on that stroke. Since there was no throttle, every power stroke was based on a full charge. A throttled engine that later replaced this one used much more gas.

L. S. TWEEDLE, Hamilton, Ont.

Clutching at Clutches

THE Ferlec transmission used in the Renault and mentioned by one of your readers ["PS Readers Talk Back," Sept.]

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"Doing spare time repairs on Radio and TV. Soon servicing full time." CLYDE HIGGINS, Waltham, Mass.

"I had a successful Radio repair shop. Now I'm Engineer for WHPE." V.W.WORKMAN, High Point, N.C.

"There are a number of NRI graduates here. I can thank NRI for this job." JACK WAGNER, Lexington, N. C.

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is not a magnetic oil clutch. It is a friction clutch with an electromagnetic actuator.

The new Peugeot is offering (as an optional extra) a magnetic oil clutch built by Jaeger, maker of most of the speedometers in French cars. The Peugeots also use an electromagnetic clutch on the fan, but this one is a friction clutch. Why they don't use the magnetic oil clutch there, too, I cannot imagine.

JAN RAVEN, Aix-en-Provence, France.

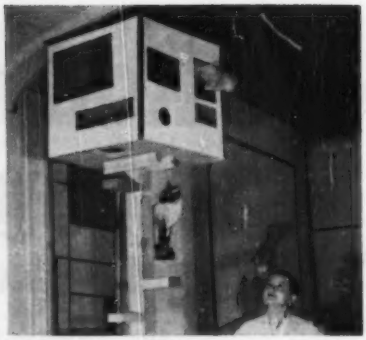
Creeping with Brakes

PLEASE tell the man who'd like to see brakes on automobile mechanics' creepers [Oct.] that we've been marketing creepers with highly successful brakes for many years. There is no other creeper brake on the market that we know about.

REED O. HULBERT, PRES.
THE SMASH-PROOF CO., Ashtabula, Ohio.

Bones in the Living Room

FROM the day that my October issue arrived, I've been wondering about that utterly mysterious leg bone, ostensibly an animal's, above the woman's head in



the photo on page 176. I suppose it figures: Anybody who would build a penthouse for cats in his living room might reasonably be expected to mount a large animal's leg bone over the fireplace instead of a picture. Maybe it was part of a dog that once chased the cats.

WESLEY S. GRISWOLD, Santa Monica.

Riveter Applauds Riveting

I MUST compliment Mr. Burton for so thoroughly covering "The Handy Art of Riveting" [Oct.]. I started out as a sheet-

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metal worker over 50 years ago—using tinner's rivets on light sheet metal. Later I did a lot more riveting—bigger rivets, of course—making boilers. Then I turned to aircraft sheet metal, using many different types of rivets.

I spent over 31 years abroad with industrial firms and in military service, working with mechanics on every continent. My last work was out in the Orient with the Chinese and Japs. The latter are hard to beat in anything they do. I'd have to rate the Germans high, too, in technical fields. I was on duty with the Muscovites a while—before Pearl Harbor—and it looks like we'll have to reckon with them in technical fields.

ALEX BRADFORD SR., Goleta, Cal.

Lost a Hubcap Lately?

THERE'S a new gimmick in use in several sections of New Jersey to prevent hubcap thefts. The car's license number is engraved inconspicuously on each hubcap near the tire valve.

Gas stations provide the service without charge. They use a vibrating steel pencil operated electrically. In some communities the police promoted the idea, and in others the project is run by the Junior Chamber of Commerce.

L. C. WEST, Mountainside, N. J.

Trials of a Trailer Dweller

BECAUSE I live in a metal-covered trailer, my transistor radio wasn't bringing in any stations. It worked fine outside with the built-in aerial, but as soon as I brought it indoors, the volume disappeared. I had no other aerial, so I improvised one.

I coiled about a foot of No. 18 plastic-covered copper wire around an electric-light cord that runs my razor. Then I taped the end of the copper wire onto the radio's built-in aerial.

With the drop cord plugged into its receptacle, but with no current passing through it, I turned on the radio. Volume increased greatly and I could get all stations. I was now using the wiring in and

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out of the trailer as an aerial—and a very satisfactory one, too.

JIM HOLROYD, Athabasca, Alberta.

Questions on Small Cars

I READ "Battle of the New U. S. Small Cars" [Oct.] with interest. The Corvair's better traction and absence of antifreeze worries are mighty appealing to me out here on the farm. But with rear-wheel weight a critical factor, why can't that heavy hunk of battery be carried up front?

BLAINE RUNNER, Hershey, Neb.

. . . I WONDER why Ford designed a 100-hp. six for the economy car rather than split a tried-and-true 200-hp. V-8 down the middle? It would have to have some new parts—a block, for instance—but many of the already tooled parts—head, valves, pistons—could be used. I'll admit a four isn't as smooth as a six, but it's for an economy car, isn't it?

BILL WELSH, Miamisburg, Ohio.

. . . In "How U. S. Small Cars Compare," you list the following imports: Ford Anglia, Opel Rekord, Renault Dauphine, Simca Aronde, and Volkswagen.

This comparison presents a distorted picture, both as to horsepower and size. Typical imports that could have been listed in a comparison of this type: Ford Zephyr, Vauxhall Velox, Citroen ID-19, Peugeot 403, and Austin A-95.

Considering the high standard of this article, it was disappointing to see an unbalanced class comparison.

F. V. DALY, Ottawa, Ont.

The five imports selected for comparison with U. S. compact cars were those with the largest sales here—hence, considered of most interest to U. S. drivers.

Praise for Eye Doctor's Tips

THANKS for all the good tips in "Arranging Your Shop for Better Seeing," [Nov.]. There should be a lot more eye comfort, now, for the hammer-and-saw fraternity. I'm glad you remembered the large proportion of hobbyists who can't

CONTINUED

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see the head of a 10-penny nail without putting on their glasses.

Speaking of glasses, tell your readers never to chuck out their old ones. Send them on to New Eyes for the Needy, Inc., 66 Highland Ave., Short Hills, N. J. They send usable plastic frames to medical missions abroad. Metal frames go to a refinery and the cash obtained is used to buy new glasses for people who otherwise couldn't afford them.

F. G. SMITH, NYC.

Six-Footers, Please Note

BY NOW, you probably are aware that an error in the Automobile Manufacturers Association specifications questionnaire resulted in the publication, in POPULAR SCIENCE and other magazines, of a false comparison in head-room dimensions for the Falcon and Corvair. We shall appreciate anything you can do to correct the erroneous impression that the

Corvair has about five inches more head room than does the Falcon.

J. O. WRIGHT, V.P.
FORD DIVISION, Dearborn.

On Keeping Shoe Laces Tied

THAT Portland man who can't keep his shoe laces tied ["I'd Like to See Them Make," Oct.] won't have any need for special laces if he'll try this: Coat ordinary laces with the dressing used on radio-dial cord. It works like a charm.

PAUL S. TRITT, Columbus.

. . . TELL the man with the flapping shoe laces to take two turns around the right-hand loop when tying the ends, pull the left-hand end through and tighten. I've been doing this for years and never have any trouble with loosening laces.

W. M. BUBIER, Westfield, N. J.

. . . A NURSE told me how to tie what she called a "Boston" knot and I've never had a shoe lace come untied since.

1) Make a simple knot and pull it tight. 2) Form a loop in each lace end. 3) Pass loop A over and under loop B. 4) Pull both loops out tight. A slight pull on either lace end and the whole thing unties like any ordinary knot. Costs no

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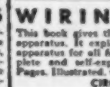

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MILLIONS IN MAIL ORDER

An open letter to anyone who wants to make MORE MONEY with LESS EFFORT!

Dear Friend:
If you're like most people, you have always dreamed of "some day" starting and owning a nice little Home Mail Order business, so you can quit knocking yourself out day after day, with no **real** money to show for it. "What a relief," you have thought. "Just to pick up orders and money at the Post Office, with almost nothing to do but spend your profits." No traveling. No hard selling. No night work.
And you want to know something? That's **exactly** the way a Mail Order Business **can be**, under the right circumstances. I am doing it myself. I've helped other ambitious men and women to do it. And I'll help you, if you'll let me.

Start Now—No Experience Required

I'm not talking about a long winded book on "Mail Order Methods," or a "Course of Study" that will take you a year to digest and still leave you up in the air! You've answered ads like that. I am sure . . . only to be disappointed and perhaps even annoyed that they **promised so much**, and turned out to be of such little **practical** value. No . . . I'm not trying to educate you. My purpose is to **set you up in a profitable Mail Order Business** . . . not next year or next month, but **right now** so you can start making money the **same way I do.** A way that has brought me security and financial independence.

The Secret Key That Has Made Millions

The heading on this ad mentions what I call the "Secret Key," and says it has "Made Millions in Mail Order." And that's no exaggeration! It is responsible for some of the most **fabulous successes in history!** There's not room here to explain it . . . but if you show a **sincere interest** by mailing me the Coupon below, I'll send you a **FREE sample** and tell you how to use it . . . to make more money with **less effort** than you have ever imagined, even in your wildest dreams! That's Step No. 1 of my plan to set you up in business.

Cash In On Foreign Made Products (Imports)

Everybody knows that there is a **fantastic profit** in IMPORTS . . . that items costing 50c or $1 abroad often sell up to $5 and $10 in this Country. But what most people **don't realize** is that importing procedures are **too complicated** for the average person to undertake on his own. **And that's where I come in.**
I am already importing watches, and ceramics, and sporting goods, and hundreds of other fast-moving items from all over the world. . . . Now you can do the same **without** experience or previous Importing knowledge!

No Investment In Merchandise, No Face To Face Selling!

My secret Key Plan is an airtight Program, all laid out for you ready to go. I make everything available to you at once! You do not advertise; you do not prepare advertising literature of any kind. You do not invest in merchandise or inventory. You do not **even handle** the Imports that you sell so easily, by mail, to the public. About all **you have** to do is go to the Post Office for your mail, then to the Bank with your profits! That's step No. 2 of the Program I offer you.

Exclusive Franchise If You Act Now And Can Qualify

Once you **start** making money in this exciting way, you'll want to make sure it will last . . . so my 3rd and **final** step is to offer you an opportunity to have an **Exclusive Franchise** to hold as long as you qualify. With this Franchise as protection you may make **more**, and **more** and **MORE.** Start as small as you wish at home, build a big business requiring a special building and dozens of employees, if that is your ambition.
My own beginning was made with about $50 capital, and no help from anyone (such as I now offer you). Today my sales by mail have long since passed the **million dollar** mark. I own a big home and my own business building, drive to work in a Cadillac, pay out thousands of dollars a month to employees. And every penny of this came from **mail order profits.**

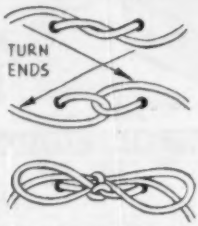
Airmail the Coupon today sure.

Only a limited number of Exclusive Franchises are available. I'll see that you get the FREE sample of the "Secret Key" along with complete details of my **Entire Secret Key Plan** immediately. No cost or obligation. Just fill out and mail the Coupon NOW! You will **always** be glad you did!

Cordially yours NELS IRWIN

money, time, or trouble. Anybody who hasn't two left hands can manage it.

H. S. GLICK, D.D.S., Los Angeles.



. . . MAY I suggest to Jack DeMent that he use a sailor's knot to tie his shoe laces and thus end his troubles? A shoe salesman showed me how to get rid of the untied-shoe headache, and it works.

HERMAN MOULTON, Detroit.

Ode to a Split-Level Wonder

It was made to help the shopman
Who is using power tools,
Wants to lock them safe from children,
Awkward neighbors, daring fools.
Although modern in appearance,
Rigid standing, light but strong,
It retains the well-known features
Of the benches known so long.
All the tools are safely grounded;
Want to use them—push the switch.
Stand up at the higher level;
Sit down at the lower, which
Was constructed, too, for jobs that
Want support in many ways.
Should you want to use the sawhorse
Or the vise, it's sure, it stays.
And that pull-out gluing table—for
Using clamps as masters should—
That is just another reason
Why that bench is really good!

H. G. ZOLL JR., Weaverville, Cal.

. . . YOUR September issue was a dandy. The tear-out blueprint for the split-level workbench is terrific.

Why not have a blueprint for a different project each month? I put in my vote for overhead garage doors and some simple furniture pieces.

L. P. PLURIS, San Diego.

Drum Vs. Barrel

YOUR illustration of what you call a "barrel agitator for chemicals" [Oct. p. 196] actually shows a steel drum. A barrel is constructed of wood. Furthermore, there is no such thing as a barrel agitator—an agitator is always a steel drum.

LARRY SKLAR, Cincinnati.

Unless it's a nine-year-old boy.

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2. **OPPORTUNITY CATALOG** is a complete directory that outlines opportunities in the particular field in which you are most interested. Gives you down-to-earth facts on just what you can expect and how you can start now toward success in your field.

3. **SAMPLE I. C. S. LESSON** (math) demonstrates the famous teaching method by which so many people have achieved amazing success. Literally thousands of men and women of all ages have won promotions, security, better pay through I. C. S. training.

* *SEE OTHER SIDE FOR FULL DETAILS* →

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Without cost or obligation, send me "HOW to SUCCEED" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

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- ☐ Architecture
- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
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- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

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- ☐ Magazine Illus.
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

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- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Technician

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- ☐ Aircraft & Engine Mechanic

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- ☐ Business Management
- ☐ Cost Accounting
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

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- ☐ Chem. Lab. Technician
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- ☐ General Chemistry
- ☐ Natural Gas Prod. and Trans.
- ☐ Petroleum Prod. and Engr.
- ☐ Professional Engineer (Chem)
- ☐ Pulp and Paper Making

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- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Sanitary Engineer
- ☐ Structural Engineering
- ☐ Surveying and Mapping

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- ☐ Architectural Drafting
- ☐ Drafting & Machine Design
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting
- ☐ Structural Drafting

ELECTRICAL
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- ☐ Elec. Engr. Technician
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- ☐ Practical Electrician
- ☐ Practical Lineman
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- ☐ Gas-Elec. Welding
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Metallurgy
- ☐ Industrial Safety
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Professional Engineer (Mech)
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design
- ☐ Tool Making

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- ☐ Practical Radio-TV Eng'r'g
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Canadian residents send coupon to International Correspondence Schools, Canadian, Ltd., Montreal, Canada. . . . Special low monthly tuition rates to members of the U. S. Armed Forces.

PICK YOUR OWN SUCCESS STORY FROM THIS PAGE

These are the true stories of people who seemed trapped in routine, low-pay, shaky jobs. Handicapped by a lack of proper training they couldn't get the things they wanted out of life—more money, job security, happiness.

They are a small sample of thousands of men and women—young and old—who turn to I.C.S. for help. Their will to learn plus I.C.S. training have changed the course of their lives.

Are you discouraged with your job and pay, feel you can't improve yourself because of a lack of specialized training? Well, these men and women were in the same boat. But I.C.S. made the difference. Their success stories could be yours as well.

Mark and mail the coupon above today.

Wins $3000 contest—"After my I.C.S. Courses I secured a new position," says Mr. Cecil Rhodes. "My income has more than doubled and I recently won a $3000 sales contest."

From clerk to assistant estimator. "Any way you look at it," writes Mrs. Edna James, "the time and money one spends for I.C.S. Courses will be repaid a thousandfold."

"As a college student I found I. C. S. very valuable." Robert Lee took the I.C.S. Course in Advertising, is now Promotion Manager for a large corporation. "I.C.S. got me started on the way up," he says.

Doubles his income—"I.C.S. made my engineering work more interesting," reports Frank Bachtik. "I was making $192 a month. But through I.C.S. my present income has more than doubled."

3 FREE BOOKS are yours as a gift from I.C.S. to show you how to get started on the road to better pay, real job security.

FOR REAL JOB SECURITY—GET AN I.C.S. DIPLOMA

VIRGINIA "My 10th year and business keeps growing. Have made as much as $485 in one day" E. Roddey, Hampton.

CALIFORNIA "Made as much as $347 on just one job. You can't miss with Duraclean" . . . C. W. Morris, Sacramento.

SOUTH DAKOTA "Earned $1571 in a single month. Homeowners here have great need for our services" . . L. Canaday, Rapid City

ARKANSAS "Every person thinks of owning a business. I know of no other which can offer a man so much" . . . E. Bailey, Hot Springs.

These Men are Building Lifetime Businesses!

ILLINOIS "Have averaged over $50,000 my first 3 years. Hqtrs' help make it possible" M. Lyons, Chicago.

MINNESOTA "Averaging over $300 per month part-time. Nothing beats being your own boss" . . . T. Mason, Winona.

NEW YORK "National advertising is tops. One lead from Hqtrs' got me 3 jobs totaling $500" . . . T. Cook, Freeport.

6 WAYS TO MAKE MONEY

You get exclusive use of unique absorption process which cleans carpets and upholstery without harmful scrubbing, soaking or shrinkage. It's acclaimed by housewives, mfrs and backed by McCalls and Parents' Seals. Five other profitable services are **soil retarding, mothproofing, flame proofing, spotting and carpet repairing.** Thus, on most jobs you multiply profits. "*Headquarters say gross $9.00 per hour. I gross up to $12.00. Many dealers I know do even better,*" says Dan Chilcott of N. Platte, Neb.

You, too, can make BIG MONEY IN THIS Booming Industry

IN YOUR TOWN, there's a real opportunity right now for you to meet the growing demand for cleaning of costly carpets and upholstery . . services for which homeowners are ready to pay good money. Mechanical methods have proved to be harmful to fabrics, so the field is wide open with our exclusive, safe, scientific absorption method of cleaning. Have you investigated this opportunity? Thousands like those above have, and are now enjoying the financial security of their own business. Many have started part-time and so can you!

This business is easy to learn, and quickly established. There's no shop needed . . you operate from home and provide all services in your customer's homes.

We'll train you, show you the proved methods for operating and building your own business, and then back you with 25 continuous services.

By starting now, you will be getting in on the GROUND FLOOR of a $750 million a year industry!

WE HELP YOU GROW

Under our unique cooperative program, you are fully trained through a nearby dealer and at our 50-hour training school. You're kept up-to-date through monthly magazines, nat'l conventions, and at regional meetings where Hqtrs' staff *come to you* in your area. You're backed by nat'l advertising in consumer (McCalls, Parents', House & Garden, etc.) and trade magazines. Others of 25 services which help assure your success include: Individual counseling (staff of specialists give you prompt, expert counsel), ad kits, folders, product development, plus others.

EASY TERMS Moderate payment establishes your own business—pay balance from sales. We furnish machines, sales material and enough supplies to return your TOTAL investment.

ONLY PROCESS TO WIN THESE HONORS

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". . superior to any on-location process with which I'm familiar." —*President, Modern Tufting Co.*

". . we approve this process . . in keeping with better service to Mrs. Housewife." —*Alden Rug Mills*

Send for FREE booklets

Free 16-page booklets detail dealership program. No obligations, no salesmen will call. Clip and mail coupon today.

DURACLEAN CO., O-181 Duraclean Bldg., Deerfield, Ill.

"OWN A BUSINESS" COUPON

DURACLEAN CO., O-181 Duraclean Bldg., Deerfield, Ill.

Please rush FREE 16-page booklets which detail how I may own my own business. I understand I am under no obligations and no salesman will call.

Name.....
(please print)

Address.....County.....

City.....State.....

...have you heard...?

How much should you weigh? The weight-for-height charts in most of the penny weighing machines are now out of date. After 30 years, the Society of Actuaries has issued new figures based on a four-year study of nearly five million insurance-policy holders. (The chart gives a partial list.)

The new body dimensions are not all that the survey revealed. Other facts indicated a closer link between high blood pressure and mortality than had been previously thought. Even a small increase in pressure raised the death rate.

The same is true of weight. The lowest death rate was found among persons with low blood pressure who at age 30 weighed from 15 to 20 pounds below average. On the other hand, death rates were 10 percent higher than average for men 20 pounds overweight; 25 percent higher for 25 pounds; 50 to 75 percent for 50 pounds.

When overweight and high blood pressure were found together, the death rate rose more sharply than either condition accounted for separately.

More of a problem for men? The average man in his twenties or thirties today weighs five pounds more than his counterpart 30 years ago. Women weigh five pounds less. But weight gains can be corrected: The survey showed that an overweight person who cuts down and stays down gains in life expectancy.

AVERAGE WEIGHTS OF MEN

	Age Groups						
Height	17-19	20-24	25-29	30-39	40-49	50-59
5' 6"	135	142	148	153	156	157
7"	139	145	151	157	161	162
8"	143	149	155	161	165	166
9"	147	153	159	165	169	170
10"	151	157	163	170	174	175
11"	155	161	167	174	178	180
6' 0"	160	166	172	179	183	185
1"	164	170	177	183	187	189
2"	168	174	182	188	192	194

The world's biggest eaters aren't Americans, in case you're wondering. We rank sixth. Irishmen top the list—stashing away 3,510 calories a day in a diet rich in meat, potatoes, butter, and eggs. Next come the Danes, followed by New Zealanders, Swiss, Australians, Americans, and Canadians. The average American gets by on 3,100 calories a day.

Job hunting? The Federal Aviation Agency is looking for 2,000 electronics technicians and engineers for its control centers in Alaska and western U. S. The agency is planning ahead: It foresees a huge increase in air traffic in the next two years.

New books for job seekers:

A Handbook of Job Facts ($3.95, Science Research Associates, 57 West Grand Ave., Chicago 10). This gives educational requirements, special talents needed, salaries, and advancement possibilities for 239 different jobs, ranging from unskilled to professional occupations.

If You're Not Going to College (Charles Spiegler and Martin Hamburger, $1.60, Science Research Associates). This is designed to help high-school students choose their careers. It discusses the working world, how to get a job, on-the-job training, and vocational schools.

Start him toward success
with the authoritative, easy-to-understand

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21 chapters on Man cover ANTHROPOLOGY, GENETICS, PSYCHOLOGY and PHYSIOLOGY. 42 chapters on Matter and Energy cover PHYSICS and CHEMISTRY. 45 chapters on Industry cover METALLURGY and many branches of ENGINEERING.

Plus: Transportation (AERONAUTICS, ASTRONAUTICS, and AUTOMOTIVE ENGINEERING); Communication (ELECTRONICS, PHOTOGRAPHY, etc.); Health (HYGIENE and MEDICINE); Science Through the Ages; Society (ARCHAEOLOGY and SOCIOLOGY); Science In the Home. Also, 21 chapters of exciting Projects and Experiments to give your child the satisfaction of "doing it himself."

Contributors include 99 eminent scientists and educators, such as: WILLY LEY, America's foremost writer on rockets and space travel. SAMUEL L. BOOTHROYD, Professor of Astronomy, Emeritus, Cornell University. DR. KARL M. BOWMAN, Prof. of Psychiatry, Univ. of California School of Medicine. DR. LEE DE FOREST, pioneer electronics inventor. DR. THEODOSIUS DOBZHANSKY, Prof. of Zoology, Columbia Univ. DR. BENTLEY GLASS, Assoc. Prof. of Biology, John Hopkins Univ. DR. EARLE H. KENNARD, Prof. of Physics, Cornell Univ.

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The LITTLE Book of Popular Science describes 12 scientific experiments that your child can do himself; teaches him about atmospheric pressure, molecules in motion, refraction of light, etc. Shows him how much fun it can be to learn about science. *For free copy, mail coupon right now.*

Read this excerpt from a review in
"SCHOOL SCIENCE & MATHEMATICS"
(Journal of the Central Assoc. of Science & Math Teachers, Inc.)

"The reviewer put The Book of Popular Science into use for more than two months. It was eminently clear that the publication was excellent... The contributors... read like a 'Who's Who of the Scientific World'... without question up-to-date... adequate coverage of the newest scientific innovations... an indispensable item..."
(from the January, 1958 issue).

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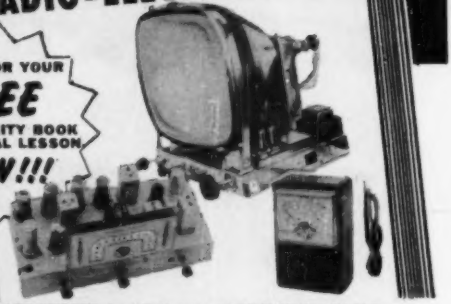

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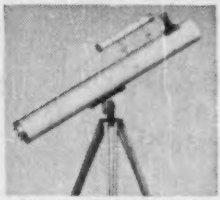

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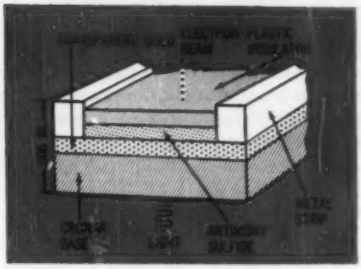
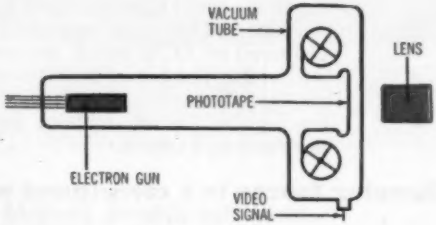
The month in science

The electronic camera. A competitor for the home movie camera may be coming out of research for space satellites. RCA has developed a "phototape" camera that records pictures as electrical patterns on a reel of plastic ribbon. When you want to see the pictures, the camera converts the patterns into signals that recreate the scenes on a TV screen. For a permanent record the signals can be put on the magnetic video tape that TV stations use. The camera itself (except lenses) is inside a vacuum tube smaller than a TV picture tube.

The "film" in this camera is a wisp of clear Cronar plastic tape coated first with gold (so thin—.0000004 inch—that it's transparent), then with light-sensitive antimony sulfide, and finally with polystyrene, an insulating plastic that retains the electrical picture. This phototape unreels behind an ordinary lens, just as in any movie camera.





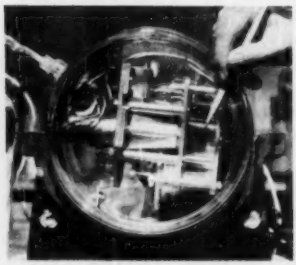
Light from the lens shines through the Cronar base and the gold conducting layer to hit the antimony sulfide, which is an unusual material that changes its ability to conduct electricity when struck by light. Where the light image is bright, the sulfide layer will conduct electricity easily; where the image is dim, the sulfide will conduct poorly. The polystyrene back of the phototape is sprayed uniformly with electrons (from a gun like the one in a TV picture tube). These electrons leak off through the sulfide wherever they can, more getting through the bright parts of the image (high conductivity) than through the dim parts (low conductivity). That leaves a charge pattern on the plastic duplicating the light image (but in reverse, like a photographic negative)—a lot of electrons where the picture was dim, few electrons where the picture was bright. The electrical picture-pattern is frozen when the electron beam switches off.

To read out the pictures, the exposed phototape unreels in front of the electron gun again, which now scans its beam across the insulator back, line by line (same as in a TV camera tube). The phototape catches electrons from the beam—more where the picture was bright than where it was dim. This electrical variation as the beam scans the tape makes a signal, again just like the one from a TV camera.

Phototape is not affected by light except when it is ready for

CONTINUED

exposure. Electrical patterns can be stored two weeks without fading, and can be read out several times before they become illegible. The pictures it makes are about as sharp as ordinary TV.



New camera with lenses removed.

First use of the phototape camera will be to get a space view of the earth's cloud cover and to map the hidden side of the moon. It will record these views whenever the satellite it rides is in the best position, then read out the pictures later when signaled to do so from earth. An ordinary movie camera couldn't do the job (no good way to get the film back), and other electronic methods that have been suggested are either very crude or impossibly bulky.

RCA makes no promises about home use, but the idea has appeal. The camera is small, and its phototape film can be used over and over again many times before it eventually breaks. You could see your pictures immediately by plugging into the living-room TV set, and preserve permanently any scenes worth saving by reading out into a video tape recorder. (The home tape recorder has been promised by RCA, which last summer demonstrated the playback part of it.) The big advantages over ordinary photographic movies are two: No waiting for the film to be processed; and viewing on the regular TV set, without darkening the room and setting up projector and screen.

Jumping fences in a car without wheels. Air sleds, those strange vehicles that slide on a bubble of compressed air (see p. 134 for a first-hand report on "driving" one) look better and better. It appears that the faster they go the higher they'll fly.

That's the conclusion drawn from three independent reports at last fall's meeting of air-sled experts at Princeton University. The reports, describing tests of models in wind tunnels, differed sharply in details but all pointed to a steady increase in lifting capacity as forward speed increased. The cause, apparently, is a speed-caused improvement in downward flow from the air jets underneath the craft. If checked out, it means:

- Cross-country vehicles—which intrigue hunters, oil prospectors and the Army—should be able to clear fences, boulders, and stumps much the way a man does. They'd speed up to rise higher and hurdle the obstacle.
- For steady runs over a smooth surface (water, for instance), the increased lift might be traded for still greater forward speed. That is, at high speed, power no longer needed to maintain cruising altitude could be shifted to propulsion.
- An airplane could jack itself off the ground on an air bubble and slide away, for a fast and short flip into true flight.

Theoretically, an air sled would continue to gain lift with increasing speed until it lifted itself right off its air bubble and flew like an airplane. This would be fatal with the present vehicles—which are not airplanes and cannot fly—but might be very nice indeed in a specially designed hybrid machine.

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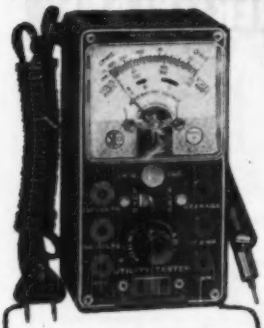

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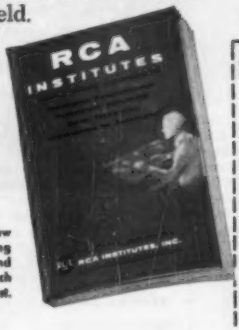

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The Amazing Potentialities of Memory

LITTLE thought when I arrived at my friend Borg's house that I was about to see something truly extraordinary, and to increase my mental powers tenfold.

He had asked me to come to Stockholm to lecture to the Swedes about Lister and other British scientists. On the evening of my arrival, after the champagne, our conversation turned naturally to the problems of public speaking and to the great labour imposed on us lecturers by the need to be word perfect in our lectures.

Borg then told me that his power of memory would probably amaze me—and I had known him, while we were studying law together in Paris, to have the most deplorable memory!

So he went to the end of the dining room and asked me to write down a hundred three-figure numbers, calling each one out in a clear voice. When I had filled the edge of an old newspaper with figures, *Borg repeated them to me in the order in which I had written them down and then in reverse order, that is beginning with the last number. He also allowed me to ask him the relative position of different numbers: for example, which was the 24th, the 72nd, and the 38th, and I noticed that he replied to all my questions at once and without effort, as if the figures which I had written on the paper had been also written in his brain.*

I was dumbfounded by such a feat and sought in vain for the trick which enabled him to achieve it. My friend then said: "The thing you have just seen and which seems so remarkable is, in fact, quite simple; everybody has a memory good enough to do the same, but few indeed can use this wonderful faculty."

He then revealed to me how I could achieve a similar feat of memory, and I at once mastered the secret—without mistakes and without effort—as you too will master it tomorrow.

But I did not stop at these amusing experiments. I applied the principles I had learned in my daily work. I could now remember, with unbelievable facility, the lectures I heard and those which I gave myself, the names of people I met—even if it was only once—as well as their addresses, and a thousand other details which were most useful to me. *Finally, I discovered after a while that not only had my memory improved, but that I had also acquired greater powers of concentration; a surer judgement—which is by no means surprising since the keenness of our intellect is primarily dependent on the number and variety of the things we remember.*

If you would like to share this experience and to possess those mental powers which are still our best chance of success in life, ask D. V. Borg to send you his interesting booklet *The Eternal Laws of Success*—he will send it free to anyone who wants to improve his memory. Here is the address: *D. V. Borg, c/o Aubanel Publishers, 14 Highfield Road, Rathgar, Dublin, Ireland.*

Write now—while copies of this booklet are still available. L. CONWAY.

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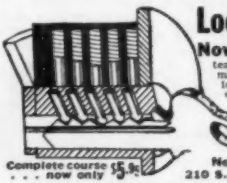

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Uranium "Let Him Down" to Success!

LIKE many another young American, Edward Walls was doing all right, in a moderate way, when the uranium bug bit him a couple of years ago.

And thereby hangs a mighty interesting tale.

Ed was a barber and hairdresser by trade. He operated a small shop in a Colorado city—and in his shop he heard glowing reports of overnight fortunes being made in uranium, the wonder-metal of the Atomic Age.

"If others can get rich fast in the uranium game, so can I," he thought. The more he pondered, the more alluring the Big Idea—uranium—seemed.

Edward Walls

So he sold his little shop, packed up his belongings and, with his young family in tow, struck out for Utah—the new Golconda! Or, so he imagined it to be.

A few months later his disillusionment was complete. He hadn't made his quick million. He hadn't even made an impressive start. Despite his hard work at a precarious job with a firm engaged in uranium reduction, the cold fact was that he was broke—and likely to stay broke.

Refused to Stay Beaten

But Ed Walls isn't the type of man who "chickens out" of life's problems. Discouragement had him down, but he was far from out!

His thoughts kept turning to an old friend of his, back in Colorado, who had bought a Rug Deterger machine some time before from the Von Schrader Manufacturing Company, 111 "R" PL., Racine, Wisconsin, long-established maker of high-quality rug-cleaning machines and equipment. This friend had grown tired of working for somebody else, and had set himself up—with no previous experience and with only a small financial stake—as an independent businessman.

"And," mused Ed, "he is doing all right for himself. He is no smarter than I am. Why can't I do the same thing? All over town there are homes with rugs just itching to be cleaned!"

So enthused did he become over this idea that he telephoned the company to arrange for the purchase of a machine and supplies, and to discuss ways and means of making the most of his opportunities for money-making in the rug-cleaning business.

Small Loan Aids Fresh Start

Once his mind was made up Walls' next job was to borrow the small amount of money he needed to get started. "I found out that it's tough to borrow even a little dough when you're broke," he said. But somehow, he *did* get the money and, with it, the machine.

"Two weeks after I got my equipment and started using it, I was able to pay back the money I had borrowed—interest and all! And I was really amazed how easy it was to get work to do. One satisfied customer would tell a friend, and that friend would tell another friend. You'd think every rug in town needed cleaning—and that wouldn't be far wrong."

Ed has grossed as much as $548 in a single week since he started his own business. Some months he takes in up to $1400 and his family isn't going hungry these days.

Plans Larger Success

At latest report, Ed Walls is setting up a training program for young men in his town. He plans to add new machines to his equipment as fast as he can train these young men to operate them and represent him throughout the area.

"A year or two from now," he says, "I hope to have a *real* success story to tell. Things are better for me than they have ever been. My dreams of making a fast million in uranium never materialized—and actually I'm glad, for they forced me back to earth, where I can deal with real people and give them a real service that I'm proud of. And I'm happier that way, in addition to making a very, very good living out of my very own business."

Clubs, Banks, Hotels and Institutions of various kinds are regularly serviced by Mr. Walls.

Mr. Walls is shown here cleaning the carpets in the home of one of his many wealthy customers.

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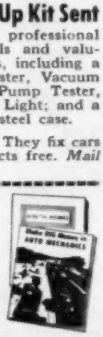

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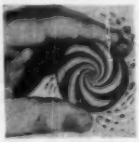

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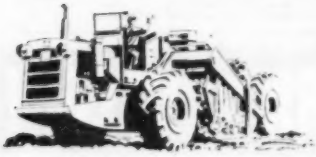

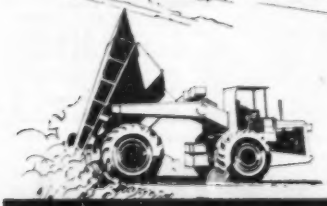

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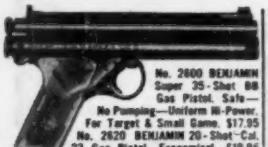

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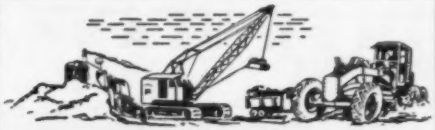

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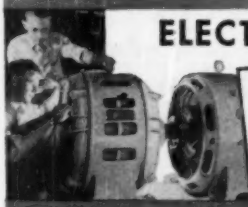

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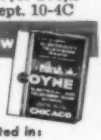

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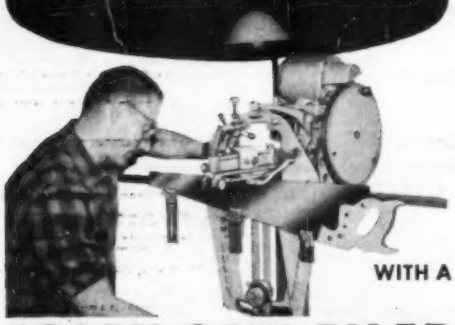

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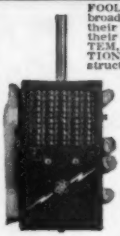

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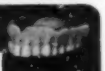

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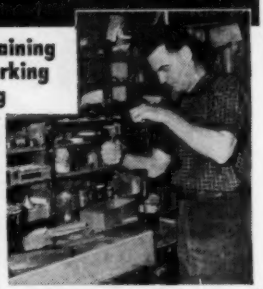

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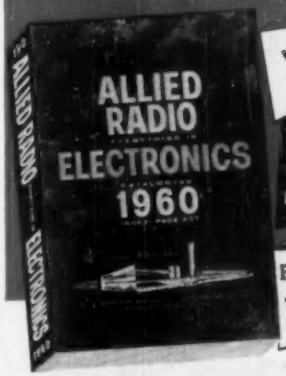

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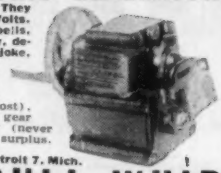

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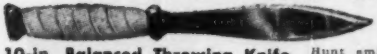

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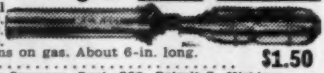

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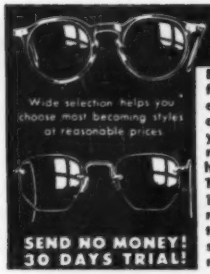

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DETROIT REPORT

By Ken Fermoyle *PS Detroit Editor*

Aluminum Muffler On Its Way?

Struggling with the problem of muffler corrosion, engineers have long eyed aluminum wistfully. It doesn't rust, it's light, and it's easily worked. The problem: It melts. Sheet aluminum just won't hold up under high exhaust temperatures, which sometimes exceed 1,000 degrees.

Steel did poorly in tests by aluminum-muffler maker.

Edward Jobson, president of Uni-Search Corp., East Detroit, Mich., figured out a new angle: Make use of aluminum's ability to conduct a lot of heat in a hurry.

He designed a cast-aluminum muffler with lots of metal at heat-concentration points, added long fins to dissipate heat rapidly. It works.

Temperatures don't go over 650 degrees, well within the melting safety range. Two models, suitable for engines of between 250 and 350 cu. in., will soon be on the market.

Price (about $27.50) will be 25 percent higher, and weight (10½ lb.) will be 40 percent lower, than steel mufflers.

Listen for the new horn. Aluminum is moving into the car-horn field, too. An aluminum-foil coil appears for the first time in a horn developed by Sparton Corp., Jackson, Mich. It will be the only horn on the market using a rectifier. The horn is lighter than the one it replaces and has seven fewer parts (38 vs. 45 for the old design).

Has the horsepower race run its course? Latest indication that it has is the conservative Valiant horsepower rating. Officially it's 101 at 4,400 r.p.m. But engineers who developed the slanted six-cylinder engine say, off the record, that it peaks at closer to 110 horses on the dynamometer.

"We didn't want to advertise much more than 100 hp. because our surveys indicate that people don't think a car with more than that can be economical, too," company officials admit privately.

Even higher horsepower is available. Development work to date indicates the rating could be pushed as high as 175 hp. in the future if necessary.

This would mean better than one hp. per cubic inch of displacement, since the 175 figure could be reached without increasing engine size beyond the current 170 cubic inches. It would be done by using bigger valves, modified camshaft,

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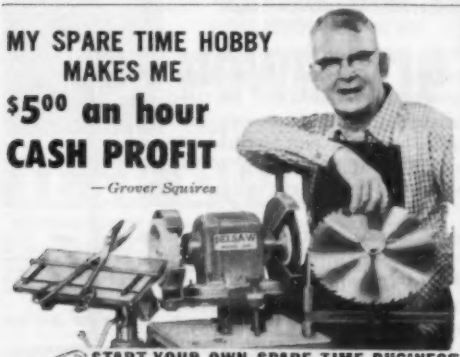

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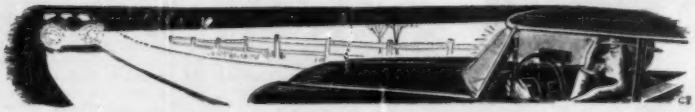
higher compression ratio, more carburetion, and similar modifications. This doesn't mean that Chrysler plans big power boosts for the Valiant. But engineers feel good knowing there's something extra on tap if it's needed.

Tinted windshields don't help at night. Nor do night-driving eyeglasses. They reduce night vision, according to the Committee on Industrial Ophthalmology of the American Medical Association. The group reports that the use of any night-driving lens or windshield, whether tinted, reflecting,



or polarizing, reduces light transmitted to the eye without actually reducing glare.

The source of night-driving glare lies in the contrast between headlights of oncoming cars and the darker surroundings. This contrast is not reduced by tinted glasses or windshields. They merely reduce the intensity of illumination from both sources, thus impairing vision.

The committee (reporting in the A.M.A. Journal) feels there is no scientific evidence to support any claim that the use of tinted lenses or windshields improves night vision.

Central hydraulic systems? Research temporarily shunted aside by compact-car crash-engineering programs, is picking up tempo again. These central power systems could be used to actuate practically all accessories, including power brakes, windows, steering, adjustable seats, convertible tops, clutches, starters, and suspension systems. (With a central hydraulic system, only such items as lights and radios would require electric power.)

Operating all these accessories from a central power source should make it possible to reduce complexity, cut costs, make installation easier, and add to reliability.

Most basic design problems involved in making a central hydraulic system work have been solved. (The Citroen DS-19 now has a central hydraulic system for its air-oil suspension, brakes, steering, and clutch.) Big tasks remaining are to simplify systems; design satisfactory, inexpensive components; and integrate them into vehicles.

Unique torsion-bar-like drive shafts could be one approach engineers may use to flatten drive tunnels within the next two or three years. Pontiac reportedly is experimenting with solid shafts having less than half the diameter of tubular shafts now used. Teamed with rear-mounted transmissions —definitely coming, by the way—they would virtually eliminate the floor hump and make it possible for six passengers to ride comfortably again.

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James G. Groendyk of Upper Saddle River, N. J., checks the mighty engine of his 1931 Duesenberg Convertible Roadster

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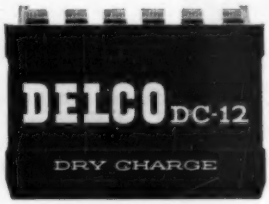
100% FRESH 

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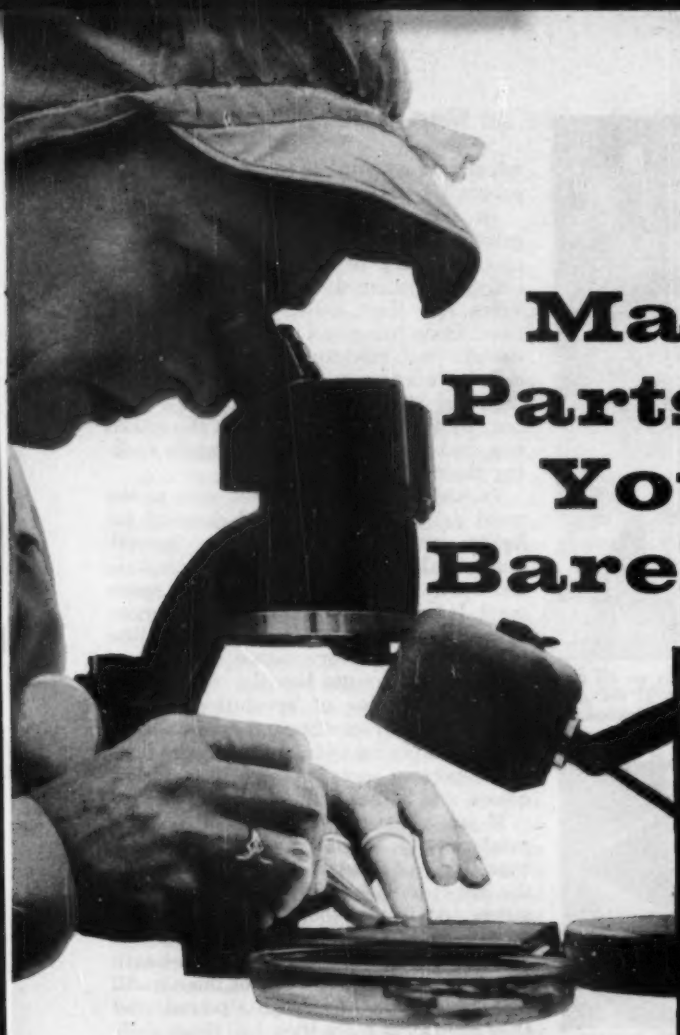


THROUGH EYE OF A NEEDLE (carpet needle, anyway) goes complete ball-bearing assembly, one of many super-small types that are specialty of Miniature Precision Bearings, Inc. Lilliputian devices are essential for missiles and satellites.

Gears that weigh 1/30 ounce and bearings so tiny that 600 just fill a thimble are performing miracles of precision in the age of space

By Harland Manchester

A MANUFACTURER at Keene, N. H., showed me a ball-bearing assembly that slips neatly through the eye of a darning needle. At a plant in Fort Wayne, Ind., I saw a nest of gears that does the same job as an automobile transmission and is about half the length of a man's thumb. In a laboratory at Camden, N. J., an engineer revealed a cube the size of a sugar lump,

CONTINUED

PHYSICIAN'S HYPODERMIC serves as an oil can above to lubricate a tiny bearing. If the girl sneezes, the unit will have to be recleaned.

HAND-HELD MAGNET picks up finished parts of micro-miniature bearings after polishing, to separate them from particles of abrasive.

SPRAY OF SOLVENT washes completed product —it's the white spot in the right center of the photo—before final inspection and polishing.

One factory's yearly output,

which was a complete radio receiving set, except for battery and speaker.

In scores of plants throughout the country, all manner of familiar devices are now being sweated down to fantastically Lilliputian dimensions. A few short years ago they called it "miniaturization." Soon things got so small they called the art "sub-miniaturization." Now they call it "micro-miniaturization." Already there are devices, once as big as a shoe box, that are barely visible to the naked eye, and the word-coiners are again racking their brains.

Incredible midgets. Chief spur to the great drive is the increased demand for lighter and smaller guidance, surveillance, calculating, and communication devices in new planes, missiles, and space craft. It takes a thousand pounds or more of missile to push one pound of satellite into orbit, and every ounce pared from the payload counts heavily. And ahead lies the promise of revolutions to be wrought in our earthbound machines by the incredible midgets, for engineers foresee important uses for them in factories, offices, and homes.

If you place the smallest ball bearing produced by Miniature Precision Bearings, Inc., of Keene, beside a housefly, the insect looks as big as a horse. An engineer hid five of them—each composed of two polished rings enclosing spheres about the size of a typed dot—beneath his thumbnail. It takes 600 of them to fill a thimble, 15,000 to weigh a pound, and they are worth more than 150 times their weight in gold.

Merely handling these metal specks is an art in itself. When they installed a high-precision machine for grinding the bearing rings, there seemed to be no way of feeding the rings to the machine. The problem was solved by leading them into soda straws and pushing them into the grinder with a thin rod. The firm makes 500 different types of midget bearings for everything from satellites to dentist's drills, and is one of the few factories in the country that delivers machinery by first-class mail. The total yearly output of 750 employees, worth about $10,000,000, could be loaded into six station wagons.

How it began. MPB got its start in the 1930s when the late Winslow S. Pierce Jr.,

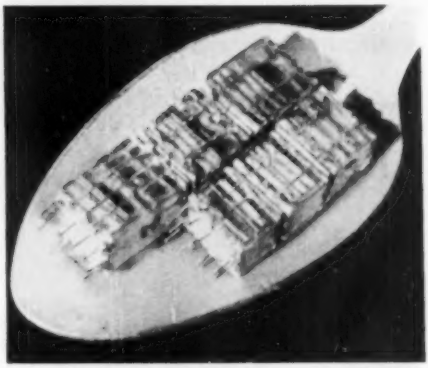
son of a New York attorney, left Yale prematurely to become a self-trained mechanical genius. Irritated because a repairman refused to put a new jewel in his ancient Waltham, Pierce set out to make a minute ball bearing to replace it. First he had to build delicate and precise tools to do the job. At great expense and labor, Pierce fixed his watch. News of the tiny bearing spread throughout the world among makers of precision instruments. Requests trickled in, and he was pushed into making the midgets at the rate of a few a day.

One order for a dozen bearings came from a man named Norden. More orders followed, and Pierce learned later that he was providing an essential part for the famous Norden bombsight.

In those days, Pierce used old washing-machine motors and alarm-clock gears to build his grinders. Mass production was impossible and rejections high. Now in a modern, air-conditioned plant, newly designed, fabulously accurate machines saw, grind, and polish steel rods into 18,000 bearings a day—most of them destined for featherweight airborne devices. One testing machine, which measures the friction of a finished bearing, responds to a force equal to one-twentieth the weight of a housefly. Another device measures the noise of a moving bearing—too faint for the human ear—and amplifies it to a mighty roar that reveals any defect.

How thin can you slice it? Horace D. Gilbert, Yale-trained lawyer and engineer who went to work for Pierce just before Pearl Harbor at $30 a week and is now MPB's president, showed me a device that tests the roundness of the balls. "If you slice a human hair 3,000 times and think of one-tenth of that," he said, "you have a rough idea of the tolerance of this machine." It takes 47 different operations to produce a bearing. The machines are largely self-directed, and have dials on which invisible dimensions are magnified thousands of times.

"Some of these machines are so sensitive," said Mr. Gilbert, "that they seem to develop neuroses like people. Turn them off for a while and they seem to go into something like a state of shock. So we run some of them all the time to keep them happy."

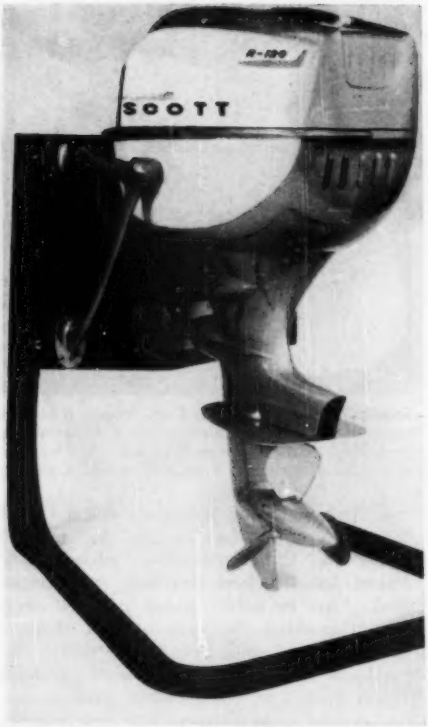


SHRINKING ELECTRONICS: That teaspoon holds a complete radio—equivalent to a six-transistor portable. Circuit elements are thin wafers stacked into cubes, a Signal Corps-RCA design.

Cleanliness that would shame a Dutch housewife is another "must." Mr. Gilbert showed me the immaculate "white room" where the finished bearings are assembled. "An invisible speck of dust may stop a bearing the way a rock stops a wheelbarrow," he explained, "so the incoming air is filtered to remove particles bigger than a millionth of an inch across. Temperature and humidity are rigidly controlled. There are no windows, for the heat of the sun would expand the parts. After chemical and ultrasonic cleansing, the parts are passed in through the air lock. The girls come in through three air locks, after thorough washing and brushing to remove lint or dust. They walk in over a special mat that removes dust from the soles of their shoes. Cigarettes, pencils, and tissues are banned. Gloves are worn for crucial operations, for oil from the skin may contaminate a bearing. A drop of sweat, a tear, a cough, or a sneeze may send a whole batch back for recleaning."

Into outer space. The finished bearings are sealed in plastic film and mailed to other makers of tiny gadgets. Because of military secrecy, Mr. Gilbert often does not know how they will be used, but last spring he was told that when the President's taped message was broadcast from the Score satellite, the recorder rolled on MPB bearings one-eighth of an inch in diameter.

[*Continued on page 214*]



Experimental outboard, hung between pivots, is steered electrically by rotating lower unit.

Four-cylinder radial engine has combined fuel-injection and ignition system on top of block.

Turbo-supercharger (at right) boosts performance, improves fuel economy, and reduces noise.

RADIAL OUTBOARD PUTS OUT 125 HP.

Twice as powerful as 1960 outboards of the same size, McCulloch Corporation's experimental engine has many aircraft features. Its four cylinders are arranged radially for perfect balance and uniform firing pulses. Fuel is injected directly into each cylinder and a turbo-supercharger rams in extra air.

Hydraulic power under electrical control turns the lower unit to steer the boat, trims and tilts the motor, and changes the pitch of the propeller blades.

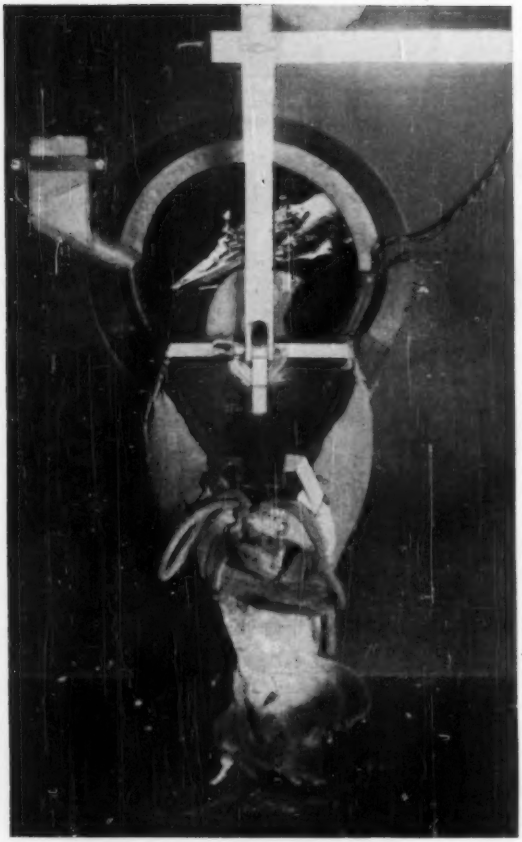
DUMP TRAIN. The side-dumping truck at left hauls a huge load of more than 50 tons of gravel by pulling two trailers behind it. Each unit takes nearly 17 tons and can be dumped to either side, singly or all at once, by solenoid-valve controls, from the cab. The new highway train is made by the Differential Co., Findlay, Ohio.

PEOPLE POD WILL FLY 20 GI'S TO BATTLE

Combat engineers at Fort Belvoir, Va., show how fast they can empty this new helicopter pickup body. The pod has five doors—no waiting after touchdown. The troop carrier was built by Sikorsky for its S-60 model. It can be attached and flown like a cargo pod, and left in the field while the copter goes for another.

FISHBOWL TALK. Glass half-bowls suspended over a shelf give privacy to phone conversations in a post office in Mannheim, West Germany, but the talkers are open to view. Maybe it will help make them hang up sooner.

SPACE DOG. The dressed-up pooch above is being conditioned at a Russian base for what it is said will be a trip into outer space and a safe return. The animal is wearing an oxygen mask and a canine equivalent of a space suit.



We Nearly Had

Just released from secrecy by the Navy is this story of one of the wackiest of weapons. It might have made a foe die laughing—but it could have worked!

PIGEON PILOT faced circular screen in laboratory "missile," the Secondary Trainer used in secret Navy tests to see if birds could steer weapons. (They could.) On screen, pigeon saw projected picture of target ship, as simulated in this composite view by inserted photo of a warship. By pecking image of ship with metal contact cemented to beak, bird operated a steering-control system to guide "missile" toward target. For accuracy, pigeon got reward of corn from mechanical dispenser. Since pigeon was supposed to keep on pecking while an image was on screen, projector light went off at feeding times.

THE U. S. once tried to train pigeons to steer guided missiles. Scientists secretly worked on the offbeat idea over an eight-year period, up to as recently as 1953, the Navy has just disclosed. And the wackiest thing about the fantastic scheme is that it would probably have worked.

It began in the "try anything" days of the war. Guided missiles were new—and guidance systems like radio control were crude, easily jammed by an enemy. What couldn't be jammed? Our wartime Office of Scientific Research and Development proposed: "Animals!"

A research contract went to University of Minnesota psychologists headed by Dr. B. F. Skinner. The required Animal X, they soundly decided, should be light in weight, easily obtained, and known to be trainable. Simple trials convinced them that pigeons would be just the thing.

With the war's end in 1945, the hush-hush project halted. In 1948, the Navy revived it. This was the idea:

A lens in a missile's nose would focus a picture of the target—say, an enemy ship at sea—on a screen like a camera's ground glass. Behind the screen, and trained to peck at any distinguishable object on it, would be a pigeon with a metallic contact attached to his beak.

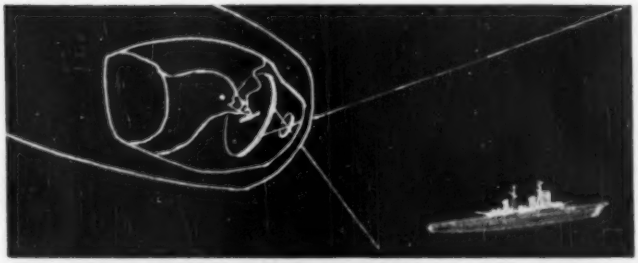
If the pigeon would make like a woodpecker upon the image of the ship, electronics could take it from there. A wire grid would register where the screen got pecked—and, through servomotors, steer the missile accordingly.

Should the missile's course err, the ship would be off-center on the screen.

Pigeon-Guided Missiles

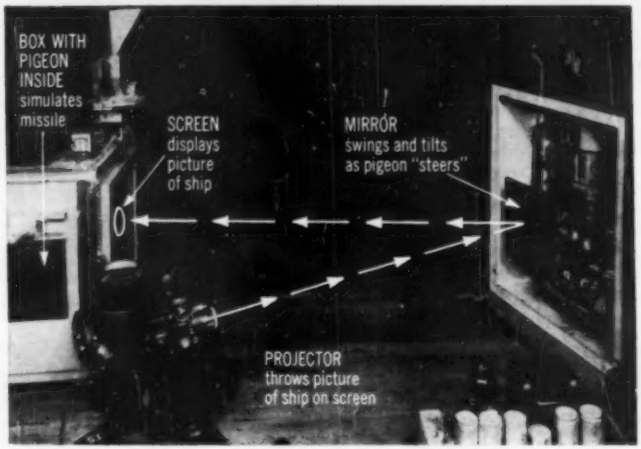
This was the idea to be tested

FANTASTIC PLAN envisioned a missile containing a lens and a screen —and a pigeon trained to steer missile by pecking at image of an enemy ship appearing anywhere on screen.



Here's how they tested the idea

COLOR PHOTOS of ships were bounced from projector to screen of pigeon-holding box by movable mirror, in Navy's Secondary Trainer. To shift scene on screen realistically in response to bird's "steering," servomotors swung and tilted mirror. Constant turning motion, which could be given mirror in addition, made ship in a still picture appear to be under way.



Pecking it would indicate this and correct the course. A pigeon would thus turn a miss into a hit—if only it could peck fast and accurately enough.

The U.S. Naval Research Laboratory at Washington took on the secret study, and it was named Project Orcon. "Orcon" stood for "organic control," the Navy's whimsical way of saying pigeon piloting.

An Annapolis for pigeons came into being at NRL. A "Primary Trainer" waggled a square target of plain metal before an opening in a box holding a bird. If he pecked at the target, he got a grain of corn. The pigeons caught on fast. They pecked skillfully, enthusiastically (up to four times a second), and for as long as 80 seconds before collecting their reward.

Encouraged, the Navy built a "Secondary Trainer" simulating the missile of its dreams. Within a box representing the missile, a jacket of netting suspended the pigeon at his battle station. He faced a screen on which color photos of actual ships were projected. A metal contact cemented to his beak, and a flexible wire from it, linked bird to controls.

The screen, a new gridless kind, was of electrically conducting glass. Resistance-measuring circuitry told where the pigeon pecked it. Then, servomotors "steered"—and a scoring system, tripping a mechanical corn dispenser, rewarded a deserving bird.

For eight promising pigeons, advanced training began. Color slides of distant and nearby ships tested their skill at holding a missile on course in early periods of an approach to a target. A

[*Continued on page 207*]

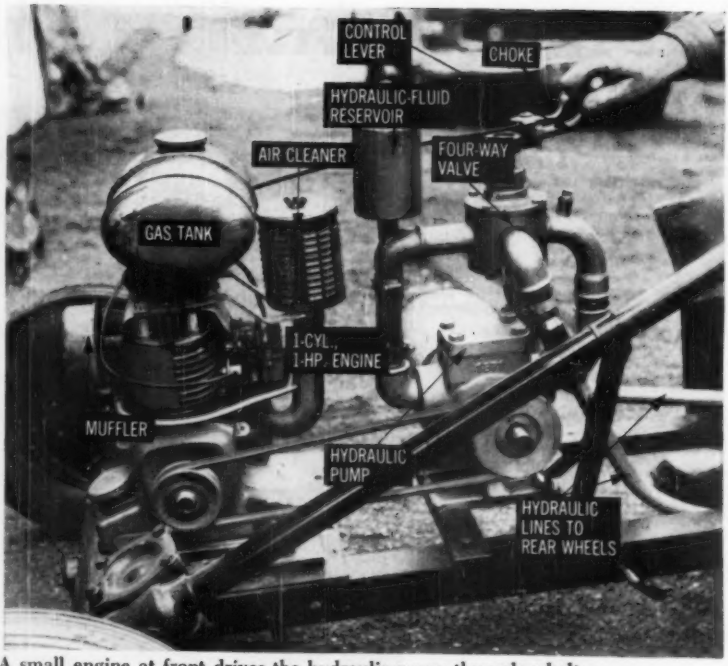
CAR RUNS ON OIL PUMPED TO WHEELS

No clutch, gearbox, or brakes are used on this little car. Its transmission is a couple of oil lines to each of the rear wheels.

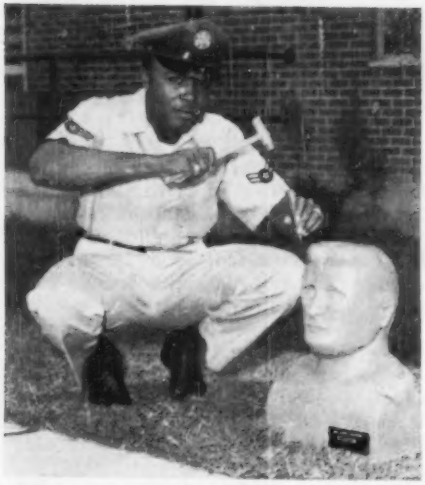
A Norwegian inventor, Johan Kallak, built the experimental model shown here in his basement.

Kallak built the car from four wheelbarrow wheels on a simple frame; a one-cylinder, one-hp. engine; a hydraulic pump; a steering wheel; the seat and back of an old chair.

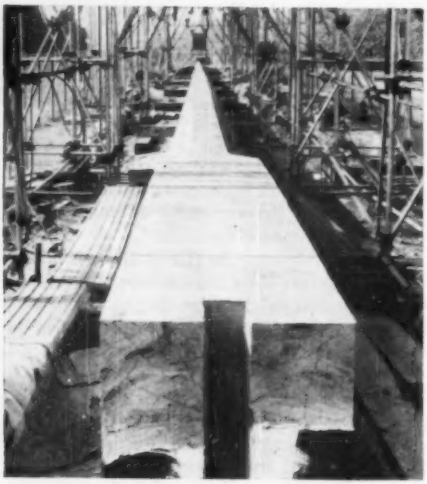
Final drive is by two hydraulic motors mounted on the hubs of the rear wheels, giving 15 m.p.h.



A small engine at front drives the hydraulic pump through a belt.

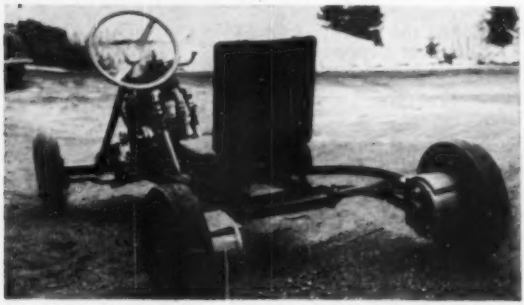


HOW TO USE TREE STUMPS. Got a problem in your yard? Airman 2/C LeRoy Jackson solved one this way at the Little Rock Air Force Base in Arkansas. With hammer and chisel, he sculptured a bust from the stump, painted it gray.



SKYSCRAPING FLAGPOLE. A gigantic flagpole is being shaped above from a 275-foot Douglas fir log. British woodworkers tapered the 37-ton trunk from a base 33 inches square to a 12-inch octagon at the top. They used chain saws.

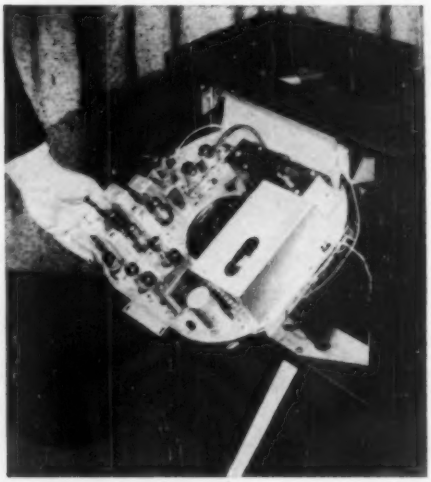
Johan Kallak starts out to road-test his car.



Hydraulic motors are fitted to the rear wheels.

TORCHLIGHTER. When a mechanical relighting device failed to ignite excess fumes atop a tower at a natural-gas plant in Alberta, Canada, an expert archer was called. Using a Wild West flaming arrow, he lit it with the first shot.

EXTENDED HEADROOM. Volkswagen owners who carry more luggage than the trunk holds may find an idea here. It's a plastic carrier that fits on the roof to provide extra space. It was shown at a fair at Dusseldorf, West Germany.



SWING-OUT TV. The chassis on this British Decca television set hangs vertically, swings out on a top hinge for testing and replacing tubes. When the set is in use, the hole in the center fits around the neck of the picture tube.

May 1, 1943: On the way home from Sgt. Maynard H. Smith's first mission over Europe, his B-17 ran into a hotbox of German flak and fighter planes. Anti-aircraft fire and cannon shells from the fighters ripped through the Fortress. Two crewmen were badly wounded, the oxygen system was shot out, vital control cables were severed, fires broke out. Three crewmen bailed out.

Sgt. Smith went into action. He rushed from his waist guns to fight the flames, to administer first aid to the wounded tail gunner, then back to his guns to drive off enemy fighters zooming in for the kill. The ammunition began to explode.

Sgt. Smith threw ammunition overboard, fought the fires until all fire-extinguishing aids were exhausted. He manned the workable gun until the Nazi fighters gave up pursuit. Then he wrapped himself in a protective cloth and batted out the fire with his hands.

The plane got home.

Here's to the memory of the Flying Fortress, the bomber that grew into an air force, the plane that could fly on a wing and a prayer—

Requiem for the B-17

By Herbert O. Johansen

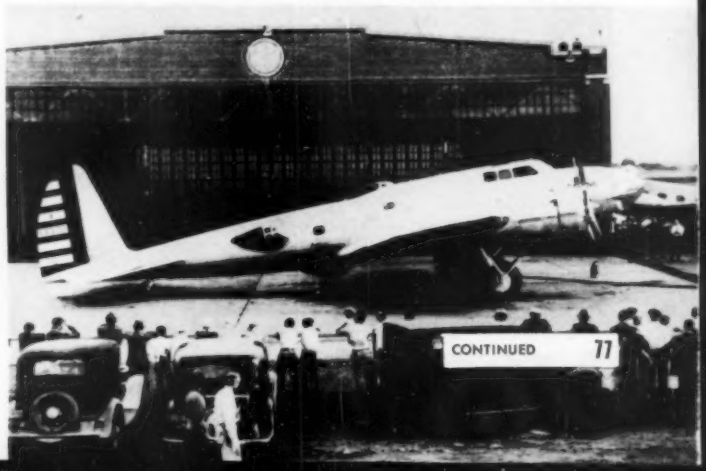
SOME say there was a ghost crew aboard B-17 No. 0483717 as she flew high above the New Mexico wasteland not long ago.

Officially she was unmanned—a remote-controlled QB target drone. Her coat of gay red paint indicated that.

The pilot of an Air Force F-101 supersonic Voodoo fighter got the Flying Fortress in his sights, locked on, pressed a button. A Falcon guided missile sped unerringly to its target. A hit.

The B-17 staggered but flew on. The ghost crew wouldn't have worried. They'd ridden Forts that had taken much

Boeing Model 299 bombardment airplane, granddaddy of the B-17 Flying Fortress, made its first bow in 1935.



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worse from enemy fire during World War II and come limping home.

A second jet interceptor took over. A second missile released. A second hit on target. The kill.

The plane whose sisters in combat over Germany had been able to take 3,000 enemy bullet and flak holes and come through—almost indestructible under World War II fire—went down finally, still flying, to its death in the desert.

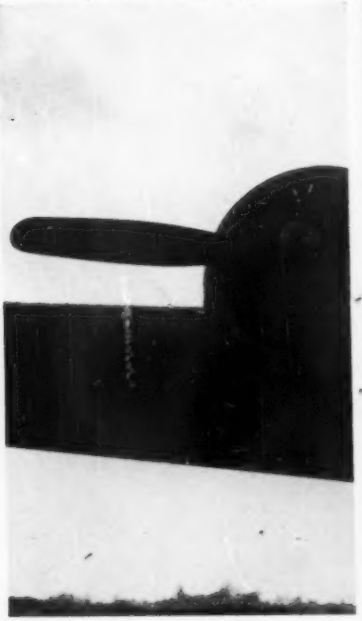
Mission accomplished—the last "combat" mission for "the greatest plane of them all"—the B-17 Flying Fortress.

The B-17 celebrates its 25th anniversary of flight this year—but not its birthday. That goes back to the spring of 1928. Claire Egtvedt, chief engineer of Boeing

Baptism of fire: Hickam Field goes up in flames. Pearl Harbor, Dec. 7, 1941, caught Hawaii-based B-17s on the ground, unable to fight back. But the Japs soon felt the sting of their firepower. Radio Tokyo called them "four-engined pursuit planes."

Ground mechanics kept

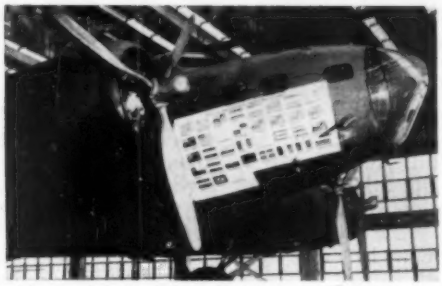
In the summer of 1942 the Germans dropped notes over British airdromes: "Where are the American bombers?" Then came the answer: mass bombing, day after day.



—Gen. Hap Arnold

Production peak came in April 1944. Here is one day's production at Boeing's Seattle plant—16 completed B-17G bombers. With this model came the deadly remote-controlled chin turret.

Flying Fortresses fought in every theater of World War II. In the Pacific they even skip-bombed shipping, attacking at mast level.



Alexander the Swoose (half swan, half goose), was rebuilt several times in the Pacific from scraps of other B-17s. It is now in the Smithsonian.

the Forts flying—sweating it out between missions, then readying them for the next.

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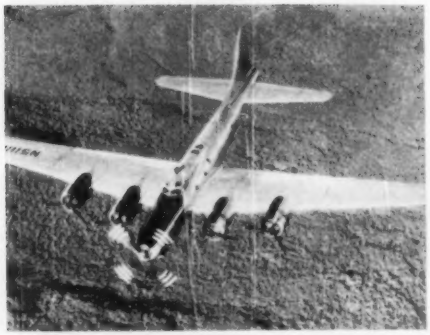


Postwar work: A B-17 that didn't go to war, its four normal props feathered, flies on an experimental turboprop engine.

At 1946 Eniwetok atomic blast, an unmanned Fort flew through the mushroom cloud. Here it is being landed.

Airplane Co., and Admiral John Mason "Bull" Reeves were in the admiral's cabin aboard the aircraft carrier Langley, tied up at San Diego. They were discussing the role of military aviation. Reeves, commander of aircraft squadrons, Battle Fleet, spoke:

"The airplane has its place, but it just isn't as effective a weapon as those we already have. The airplane isn't a dreadnought."

That word, "dreadnought," stuck in Egtvedt's mind as a challenge. In 1934 the Air Corps called for bids on a fast, heavy, long-range, multi-engined bomber. Multi-engined meant twin-engined. Egtvedt asked if a four-engined plane would qualify. It would, said the Air Corps. His "flying dreadnought" was no longer a vision.

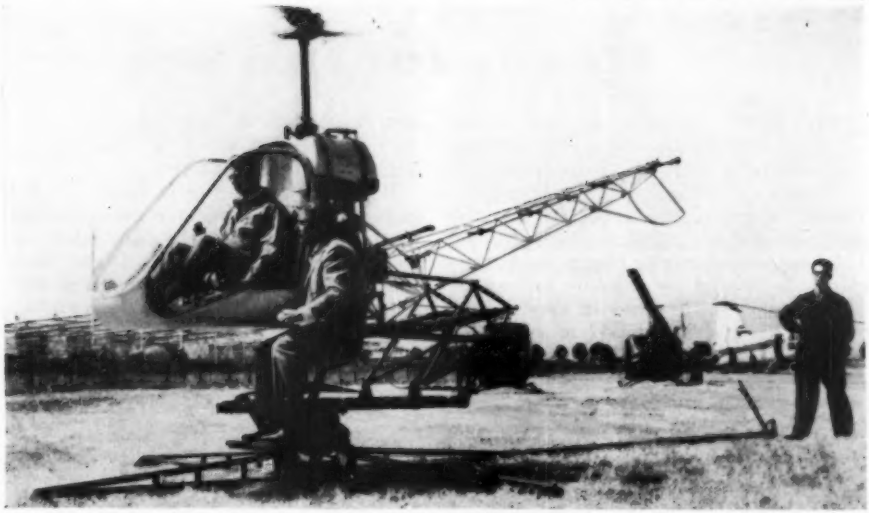
Less than a year later, as the sun rose on July 28, 1935, Model 299 bomber rolled down the runway at Boeing Field, outside Seattle. It was a gleaming giant, bristling with five machine-gun turrets.

Reporters were awed by its size and armament. It was, they said, an aerial battle cruiser, a "flying fortress."

The four engines roared as the plane raced past them, lifted into the air, became a receding speck in the sky.

They didn't know that they were witnessing the first flight of the B-17—the first of more than 12,700 that were to come off the production line within the next 10 years.

Last landing: A B-17 rests in peace atop a gas station on Oregon Highway 99. Other Forts in civilian dress are flying, making aerial surveys, dusting crops.

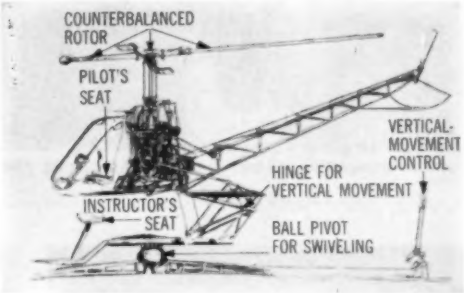


Instructor is seated beside student. Aid (right) handles lever that controls vertical lift.

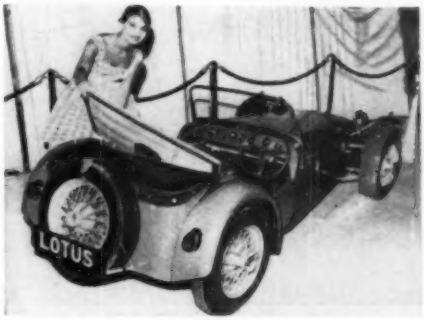
UP AND DOWN, SWIVEL AND TILT

Here's a German trainer for helicopter pilots. With an instructor at his side, the student can go through all the movements of a real copter without getting far off the ground. The machine pivots on its axis, rises on a hinged boom.

Hiller Aircraft Corp. markets the trainer in this country, has a version on a float for use on water.



STEPPED-UP BAZOOKA. This 90-mm. recoilless rifle—the Army's new MAW—fires a nine-pound shell. It shoots twice as far as the old bazooka and can destroy the heaviest tank.



DO-IT-YOURSELF CAR. The little sports model above comes in kit form. You can put it together yourself, the British makers say, in 45 hours. It's priced at less than $1,400.

Navy's Oddest Craft Heads for the Bottom

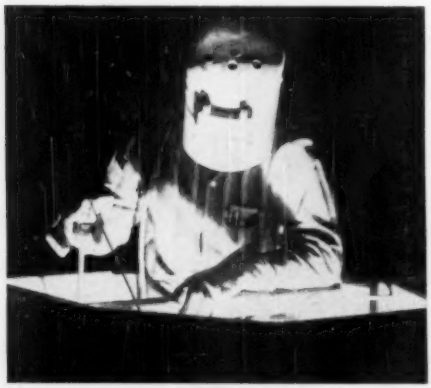
STRANGE creatures of the ocean depths off Guam are seeing and being seen by a curious visitor from the U. S. Navy. It's the 120-ton bathyscaphe Trieste, which in November set a world diving record of 18,600 feet—3½ miles.

A kind of underwater blimp, the bathyscaphe is buoyed by gasoline instead of gas. For ballast, it carries 13 tons of iron pellets. These are dumped to raise the odd craft from its deep-water prowling. The Trieste can travel a mile horizontally under battery power.

Its gondola has scant room for two men, controls, and research gear. Through windows fore and aft, the crew takes pictures by floodlight and electronic flash. They breathe a 48-hour supply of oxygen, continually recycled. They can talk to the surface on a novel telephone.

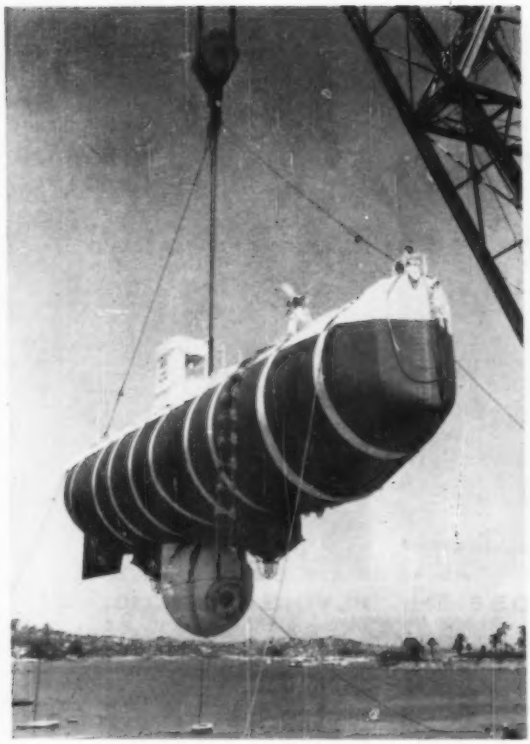
TRIESTE'S TELEPHONE sends and receives sound waves directed through the water.

The 58-foot-long diver looks like a sub when taking to water.

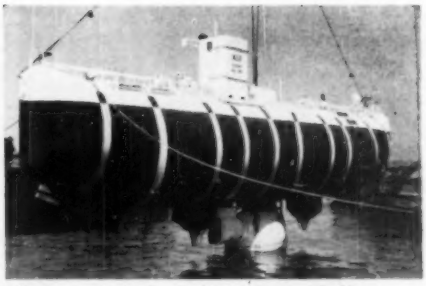


RADAR WELDER. This is no earthman equipped for the moon. He's a welder at GE's high-voltage plant at Holyoke, Mass., finishing a tank that will hold a pulse transformer for a new superpower air-defense radar system.

NEW TEETH FOR OLD DOG. It's a good thing for the 14-year-old dog here that he belongs to a dental technician. When he got too old for bones, she fitted him with a special set of false teeth with which he now chomps happily.

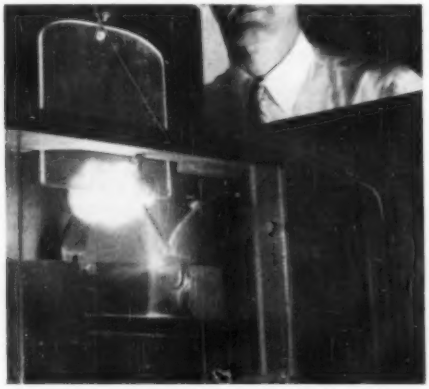


The hull contains 30,000 gals. of gasoline.



Those steel nipples hold 13 tons of ballast.

Quarters are close in the 6½-foot gondola.



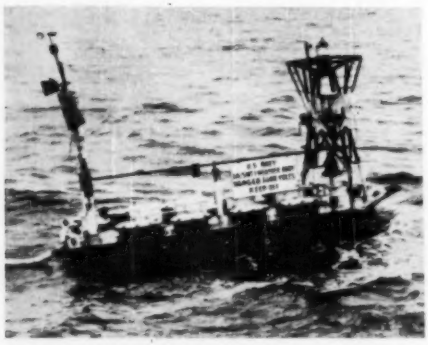
SPARK BOMB. A bolt of man-made lightning (above) sets off an underwater explosion with a force equal to 6,000 hp. The shock waves shape metal in Republic Aviation tests that may lead to shaping super-hard titanium alloys.

DESK BASIN. This French schoolboy launches a toy boat in his desk in a kindergarten class in Paris. The lid of the new desk can be pushed back so a child can use the basin during play periods. It may be filled with water or sand.

HANGING TOWER. A 13-story cantilever control tower, erected at Newark, N. J., Airport at a cost of $1,750,000, is being fitted with $1,000,000 worth of electronic equipment. Three overhanging pie-shaped floors at the 65-foot level provide a view of the runways.

FOOT-LOOSE. This little scooter was built by Louis Richards, a graduate student at Illinois Tech, to save footwork going to classes. It is made of aluminum, is powered by a 1.32-hp. model-aircraft engine, zips along at 12 m.p.h., and can be folded to fit into a canvas carrying bag.

FLYING FIREPLUG. Here's another way to put out forest fires. The helicopter, demonstrated at Lavandou, France, is equipped with a water tank and hose. It hovers over a fire area and drops the hose to a ground crew. When the water supply is used up, it goes for more.



HURRICANE BUOY. Radio-equipped buoys like the one above are being tried out by the Navy in the Gulf of Mexico to warn of approaching storms. This one transmits reports at six-hour intervals from an anchorage 300 miles out.

RAIN PROTECTION. A new bus-stop shelter for waiting passengers in Paris is made entirely of glass. This one is at the Les Sablons station on the Avenue de Neuilly. For an added bit of beauty, flowers are planted at one side.

WHILE LOONY GAS BEFUDDLES everyone in enemy-held town, liberating force can roll in unopposed. On coming to senses, foes are prisoners; civilians are freed and unharmed.

Can "Loony Gas" Win Wars Without Bloodshed?

Secret U.S. tests, now revealed, show startling military uses for weird new chemical agents

By Alden P. Armagnac

FUTURE battles may be fought without bloodshed, and wars without casualties, Army Chemical Corps officers foresee. The weapons, psychochemicals such as "loony gas," will render an enemy helpless but have no harmful after-effects.

Piecemeal at first and now in detail, the story has come out of this weird new kind of chemical warfare with which the U. S. has been secretly experimenting for some four years.

A cat fleeing from a mouse was the first hint the public had of these developments. Shown pictures of the amazing spectacle about a year ago, news readers and TV viewers learned the cat was under the influence of a secret Army Chemical Corps gas that destroyed the will to fight.

A varied assortment of these psychochemicals was under development, both in the U. S. and Russia, it was next revealed, by Maj. Gen. William M. Creasy, retired, former Chief Chemical Officer of the Army. Still without naming them, he suggested military uses, in a widely reprinted interview in *This Week* magazine. Readers included interested Congressmen who wanted to hear more.

They did—from Gen. Creasy, and from present high-ranking Chemical Corps officers. And now a 44-page transcript of what this panel of experts told the House Committee on Science and Astronautics

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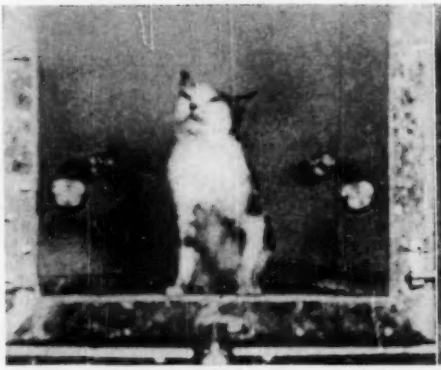
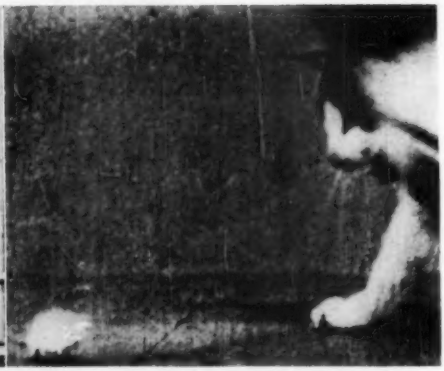
This loony-gas trial made a cat afraid of a mouse



GLASS-WALLED CHAMBER let observers watch effect of loony gas on cat placed within it, and make movie from which these scenes are taken.



TERRIFIED BY MOUSE put in chamber, cat backs into corner, flailing tail, seeking escape. In same test without gas it had pounced on mouse.

has been made public, along with a committee report. Here are highlights:

What do psychochemicals do? They make people act as if bewitched.

Strangest in effect are brain-addling chemicals, which can be loosed upon an enemy in the form of an invisible cloud of "loony gas." People who breathe it become daffy for a while.

Other incapacitating agents—mainly physical in effect, but loosely called psychochemicals, too—produce a temporary form of paralysis, shaking palsy, or blindness.

Whether people are affected mentally or physically—"off the rocker," or "on the floor," as the Chemical Corps puts it—all these effects are fleeting. In 12 to 24 hours they vanish completely.

If any weapon of war can be called humane, the new psychochemicals best fit the description. But they are not to be under-rated on that account.

For a few hours they will put enemy troops or civilians at the user's mercy—time enough for the fate of a city, an army, even a nation, to be decided.

What are these agents? The names of a few have now been revealed:

Some U. S. loony-gas chemicals, including the one used in the cat-and-mouse experiment, belong to a group called lysergic acid derivatives. Best-known of these is a hallucination-causing drug (lysergic acid diethylamide) that goes by the name of LSD. Medical researchers, studying insanity by inducing it artificially, have been giving LSD to volunteers. One pound of it is said to be enough to make lunatics of New York City's entire population.

A Soviet Army report cites the vision-inducing drug mescaline, used for the same purpose in medical research, as another possible psychochemical.

These chemical weapons are available either as powders or liquids. The liquids can be sprayed into the air to form an aerosol, or mist—for practical purposes, a gas. Heavier than air, it will roll along the ground.

A loony gas like LSD affects a person equally whether it is breathed, swallowed, or injected into the body.

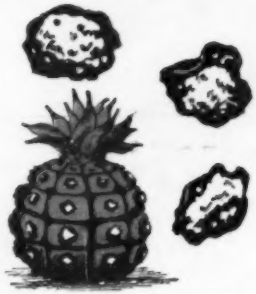
How will they be used as weapons? For military purposes they will generally be used in the form of a gas, which can be delivered to a target by missiles, bombs, and shells, and sprayed from planes and ground vehicles. Most of these are standard chemical-warfare equipment, but today's chemical-missile warhead will be something new. Bursting in air, it will eject 100 to 1,000 small gas bombs, to blanket a wide area of the ground.

In liquid form, dropped into a reservoir, a psychochemical will affect anyone drinking the water.

What happens to people? Strange things when they're exposed to loony

Raw materials call to mind a witch doctor's brews

GRAINS OF ERGOT, fungus parasite of rye, yield the loony gas LSD. Shown on rye, and life size, they are the hard, autumnal resting stage of the parasite.



PEYOTE CACTUS "BUTTONS," hallucination-causing fruit of plant shown with them, contain mescaline—a drug cited as a possible loony-gas material.

"DIVINE MUSHROOMS" of Mexico owe vision-inducing properties to newly isolated chemical, psilocybin, found remarkably akin to LSD from ergot.

gas: "If we did this to Congress we could possibly have you dancing on the desks, or shouting Communist speeches," Gen. Creasy told the House committee. "You would not think it at all peculiar to see Mr. McDonough [a member of the committee] dancing on the desk. You would probably get up and join him. And I would probably clap. Only the outsider coming in would find things unusual."

Watching a movie, the Congressmen saw what happened when about a dozen GIs swallowed LSD, and then went through a marching drill. At least, that was what was attempted—for commands like "forward march" and "right dress" threw the bewildered soldiers into hopeless confusion.

Medical reports tell how it feels to be affected by LSD. A person withdraws into a dream world. His urge to think is gone; time loses its meaning. He may feel elation—then depression or apathy. Weird hallucinations occur. Faces like colored masks appear before him. Walls move to and fro. Surroundings become tinted blue, or red. Staring at gold stars on a lampshade, one subject saw them turn into little turtles, "living and moving." Afterward, most people can remember these bizarre experiences and describe them clearly—even though lost to the world, and raving wildly, at the time.

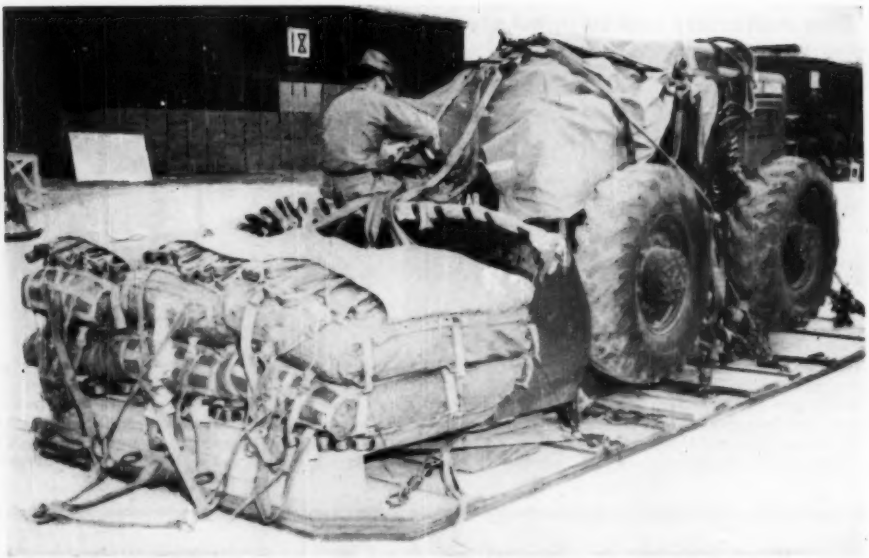
Different loony-gas chemicals can be chosen for different effects. "You do not need to drive a man completely crazy to incapacitate him," points out Lt. Col. Douglas Lindsey, director of medical research at the Army Chemical Center. "You can do this by destroying his ability to integrate time and distance, in which case he cannot judge speed. He cannot fly a jet plane, aim a gun at or from a moving tank, or con a ship from the bridge."

What are their military uses? The wide range of battlefield uses of psychochemicals includes some in which their advantages are outstanding:

"Dislodging an enemy from an area occupied by a friendly population" is an example offered by Maj. Gen. Marshall Stubbs, the Army's present Chief Chemical Officer. Unopposed, a liberating force could roll into an enemy-held town that had been saturated with loony gas, and seize control before enemy troops recovered their senses. Civilians would be spared from harm, and their homes and buildings from ruin—in happy contrast to the results of bombing and shelling.

Consider an amphibious assault on a desperately defended position. When Iwo Jima had to be taken in 1945, explosives and flame throwers were used to dislodge the Japanese. Says the committee report of the outcome: "Almost all 21,000 defending troops were killed. This country suffered 7,000 dead marines and 18,000

[*Continued on page 220*]

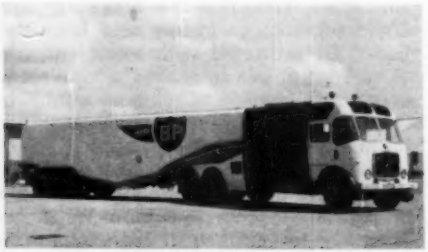


1. Six 100-foot packaged parachutes are attached to this tractor on its carrying platform.

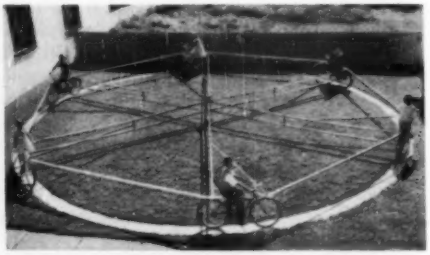
Building Airstrips from the Sky

AN AIRBORNE engineer battalion, for the first time in military history, landed in wild Kentucky country and carved an airstrip out of the rough ground. The operation took just 52 hours and demonstrated the feasibility of landing troops in territory held by an enemy.

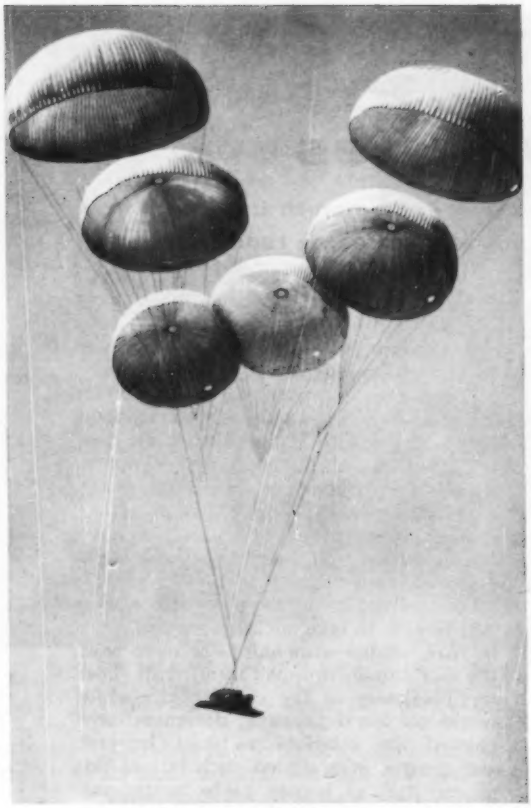
A total of 333 officers and men took part in the jump. They landed and put to work 20 pieces of equipment—bulldozers, tractors, graders, and trucks—all parachuted from the air. They brought with them food and water for two days, and weapons and ammunition to defend the position. The strip cleared was 2,500 feet long by 60 feet wide. The exercise marked the first time all the essential equipment of a battalion had been dropped.



JET SUPER-FUELER. The streamlined tank truck above has been put into use at British airports to deliver fuel for transatlantic jets. It is 51 feet long, holds 12,000 gallons, and pumps fuel at the rate of 900 gallons a minute.



MERRY-GO-RIDE. This carnival ride was built by Dr. Frank E. Dudley, an atomic scientist, for a blind 10-year-old neighbor in Westmont, N. J.—the boy in the center foreground above. Now he rides his bicycle without guides.



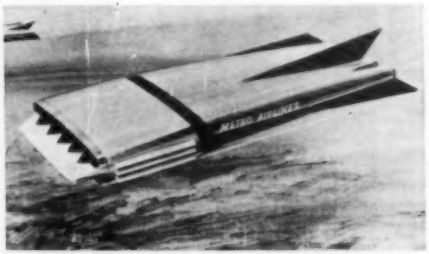
2. PARACHUTES BLOSSOM out to take the first load of heavy-construction equipment safely down onto a drop zone at Camp Breckinridge, Ky. The drop was made from big C-130s.

3. PARATROOPER ENGINEERS of the 101st Airborne Division grapple with release mechanism to free a tractor from its six huge parachutes as it lands on the rough countryside.

4. RUGGED BULLDOZERS, parachuted from the skies only a couple of hours before, start moving tons of Kentucky earth to clear a 60-foot-wide, 2,500-foot landing strip for planes.

5. JUST 52 HOURS LATER, the first aircraft—a C-123 troop transport—comes in for a perfect landing. The strip was built entirely by men and equipment parachuted to the site.

BUSTLE CAR. Here's a sports car that looks like a teardrop backing up. It has a conventional front, but its fiberglass-body contour flows to a bulging rear end. Called the Asardo 1500, it has competed in several U. S. sports-car races.



WINGLESS AIRLINER. Supersonic aircraft of the future may be built like this one conceived by Lockheed, which says it could average 62 miles a minute, house passengers in a central cabin. Its entire nose would be an intake for its jets.

Big Russian Snow Cats to Prowl Antarctic Wastes

Soviet scientists plan 3,600-mile trek in mammoth tractors that offer such luxuries as hot showers and game rooms

THE most powerful beast in Antarctica this winter will be a Russian snow tractor—a 35-ton monster that will plow across the bottom of the world by way of the South Pole.

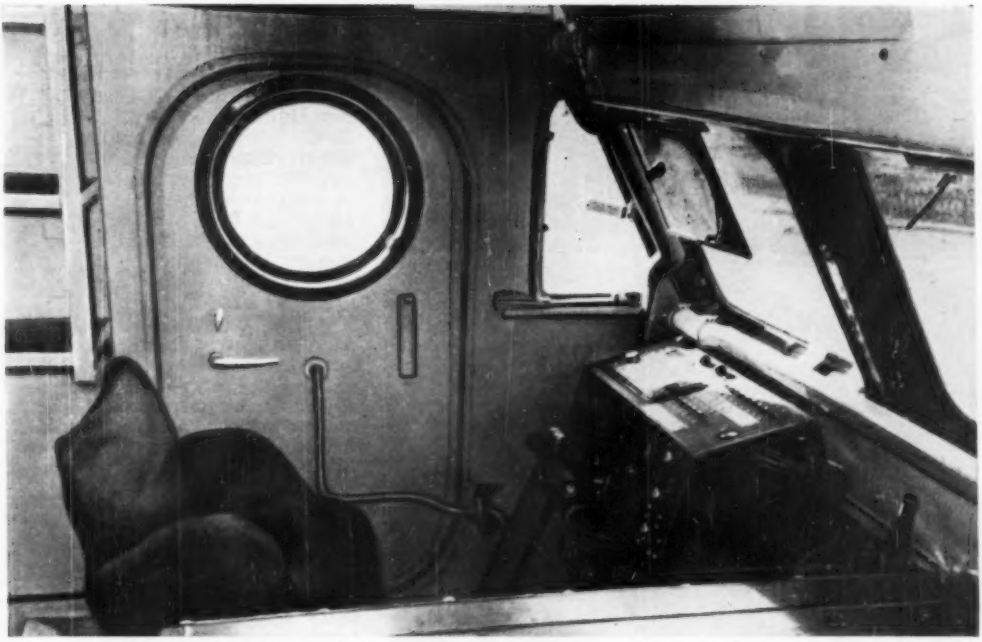
RUSSIAN ROUTE: Explorers will head for geographic South Pole from Mirny, then veer towards coast of Queen Maud Land. Below: One of the tractors that will make the trek.

Snug inside the tractor and two sister vehicles will be 24 Soviet scientists who will attempt the longest Antarctic trek in history—a distance of 3,600 miles.

They plan to make the trip in style. They'll live in warm, air-conditioned cabins fitted with separate working, dining, sleeping, and recreational compartments. They'll make seismic and meteorological measurements cozily inside—reading data off transducers that have been recessed into the cabin's outer walls and roof.

At the end of a day's work the men will be able to take hot showers and relax in foam-rubber armchairs—or even read the day's mail, dropped by aircraft. Lest the bleakness of the constant ice-white world get too depressing, designers have colored the interiors in blues, browns, and greens, even added such bits of domestic fluff as homey table lamps and porthole curtains (which also serve to screen the glare).

Providing this luxury was no mean feat.

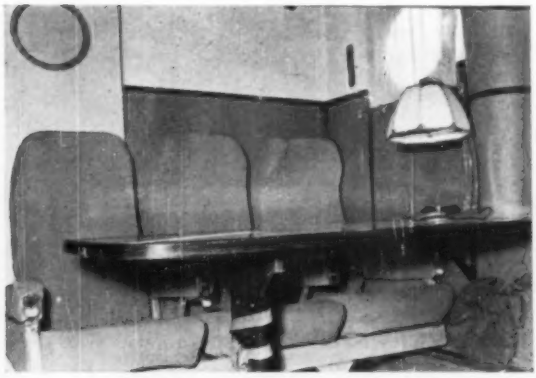


THE DRIVER'S SEAT is at the left of the control compartment. The navigator sits at his right. Despite the tractor's weight (35 tons) and bulk, it's expected to develop speeds close to 20 m.p.h., climb 30-degree grades, and make tight turns. Watertight cabin makes tractor unsinkable.

Engineers had to make a vehicle that was big and powerful but still fast and maneuverable. It had to be made livable for months at a time.

The terrain itself was their toughest problem: snow and ice, temperatures of minus 95 degrees F., hurricane winds, and high mountains. To lick it, they started, logically enough, designing the tractor from the ground up. The tracks are the most important design feature of

[*Continued on page 226*]



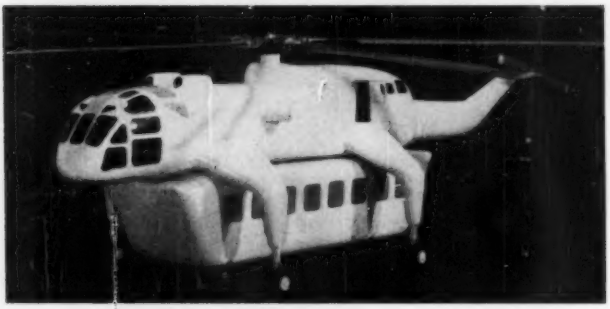
MESSROOM aboard the tractor looks like the first-class compartment of the Russian TU-114 jet. Even the lamp is the same. Behind it can be seen one of the nine curtained ports.

WORK ROOM doubles as a recreation room in the evening. Besides table space there's a bookcase and a separate apparatus room. At right, part of the six-bunk bedroom shows.

GUN ARMORED BY ALUMINUM

This is the Army's new aluminum-armored T-195 howitzer. It is a full-tracked, amphibious, self-propelled gun, so light—it weighs eight tons less than its predecessors—that it can be transported by air.

The weapon can carry a load of 89 rounds of ammunition—either standard howitzer shells or a newer, longer-range type. Its fire-control system has been simplified and its accuracy has been improved.



FROG LEGS. The British Westland helicopter at left resembles a giant frog straddling a bus. It is designed to carry field hospitals to battle areas; take on mobile workshops, field kitchens, radio units; act as a flying crane; or transport troops and other personnel, light and medium vehicles, or six tons of supplies.

HANGING TV. This wall television set is mounted on brackets in a corner. It's made in Britain by Philco, has a 21-inch tube, and is 16½ inches deep. The design saves floor space, provides flexibility in height and viewing distance.

HIGH STEPPER. The machine above was built at the University of California for spraying insecticide on crops of any height. The boom spray can be adjusted from ground level to five feet. Wheel distance can also be set to fit rows.

Keyed panel offers multiple-choice solutions.

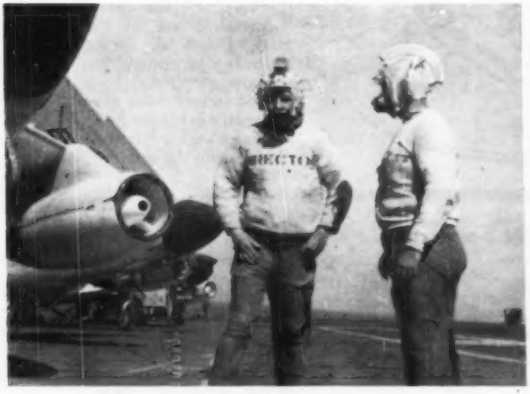
A complete course is contained on each reel.

PUSHBUTTON TEACHER WORKS WITH FILM

This new automatic teaching machine is designed to assist in intensive industrial and military-training programs.

Essentially a film reader, it uses reels that store up to 10,000 frames of instruction each. Selections are made by pressing buttons on a panel. The machine advances a student as he comes up with correct answers, grades and times work, keeps an accurate record of progress.

The device was developed by the Western Design Division of U. S. Industries, Inc. It can be programed to handle a number of different courses.



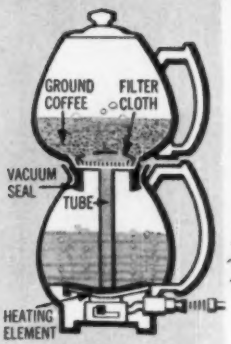
JET SILENCER. Crewmen above on the flight deck of the carrier Lexington wear antinoise helmets to deaden the sound of jets taking off and landing. Helmets are equipped with earphones and a mike for carrying on conversations.

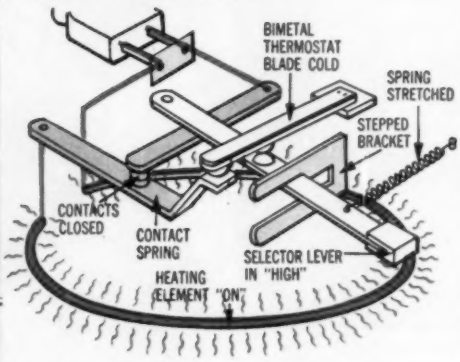
ELECTRONIC VOTING. Deputies in the French National Assembly now vote by an electronic machine. Three keys at each desk register yes, no, or an abstaining vote. The result shows automatically at the front of the room.

How Automatic

VACUUM TYPE

How it brews coffee

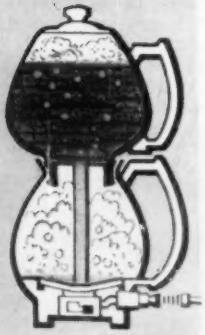


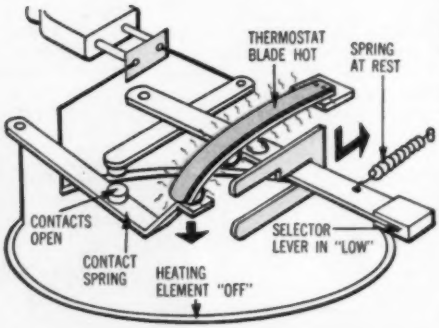


1 CONTACT POINTS, normally closed in this Sunbeam Coffeemaster, pass current to the heating element. As the water gets hot, some vaporizes. Vapor pressure in lower bowl gradually pushes water into upper bowl through the tube.

Heat coil stays "on" long enough for almost all the water to rise—if the selector lever is in High. In this position, a button on the lever rides onto a button on the thermostat blade, forcing blade upward.

How it shuts itself off



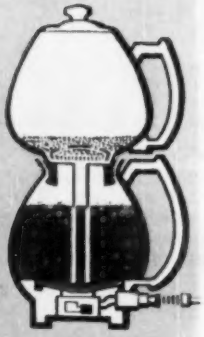


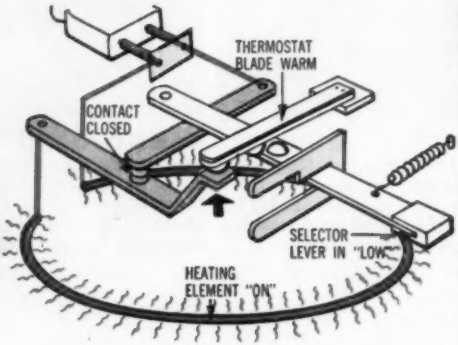
2 THERMOSTAT blade bends far enough to push against the contact spring when the blade reaches right heat. Contacts are opened and current stops flowing.

The bending thermostat blade also presses on the selector lever, shoving it out of the High notch. A spring pulls the lever over into Low position.

Just before heat goes off, water in upper bowl is agitated by vapor rising from below.

How it keeps coffee warm



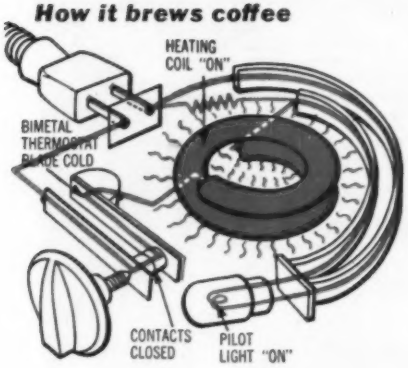


3 COOLING creates a vacuum in the lower bowl, causing coffee to be forced down into it. Cooling also straightens thermostat, which relaxes its pressure on the contact spring. Contacts close, heat goes on. With selector lever in Low—so lever and thermostat buttons no longer line up—the thermostat is more sensitive. Now it takes only a little heat to bend thermostat blade enough to open the contacts. Thermostat keeps coffee at 165-185.

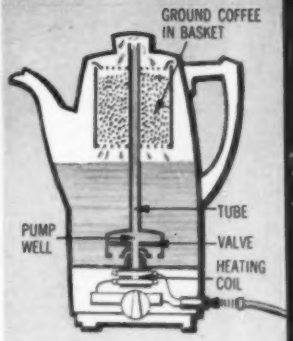
Coffee Makers Work

PERCOLATOR TYPE

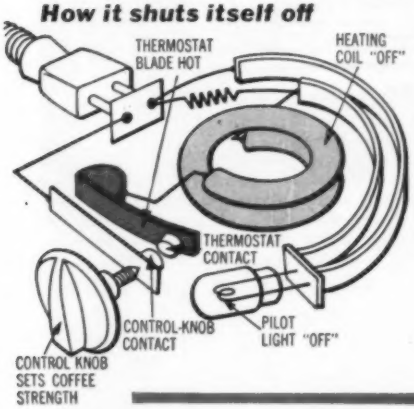
How it brews coffee



1 HEATING COIL in Sunbeam's percolator quickly warms the small amount of water in the water well. As pressure develops there, water in the tube is pushed upward. It overflows onto the basket and runs down through the ground coffee into the pot. Pressure drops in the tube because it's empty. The head of water in the pot forces the valve off its seat and lets new water into the well. Spurts of water shoot up the tube until coffee is perked.

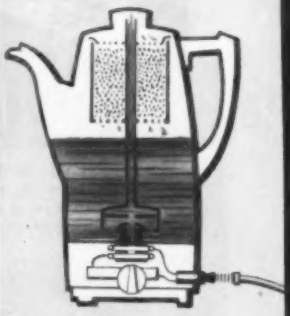


How it shuts itself off

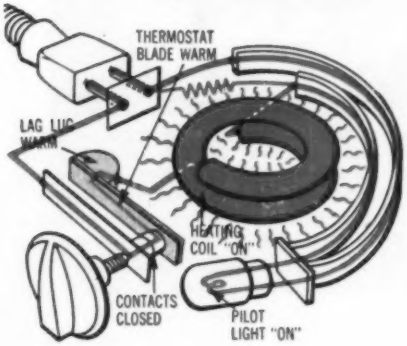


2 COIL GOES "OFF" when the thermostat blade gets hot enough to bend its contact away from the control-knob contact.

The control knob determines coffee strength by fixing the position of the control-knob contact. The "stronger" the knob setting, the farther the knob projects toward the thermostat contact. And the greater this projection, the longer it takes the thermostat blade to bend enough to open the contact points.

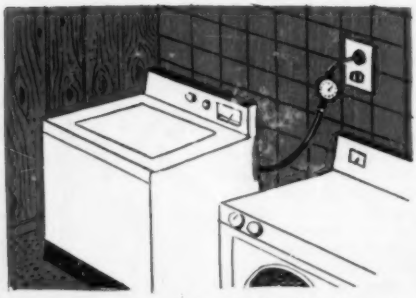


How it keeps coffee warm



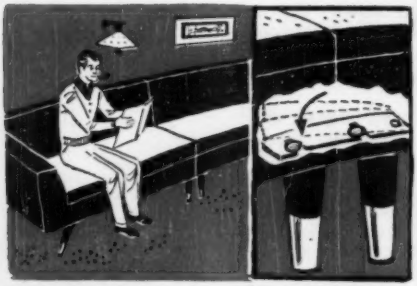
3 THERMOSTAT turns the coil on and off to keep coffee warm. Thermostat blade now reacts more quickly to temperature changes than it did during the brewing cycle. When brewing started, the blade and its attached lag lug—a chunk of metal—were cold. When warming cycle starts, lag lug is hot from heat stored up in the brewing cycle. Heat flows from lug to thermostat. Only a little additional heat bends the blade, opens contacts.

"I'd like to see them make..."



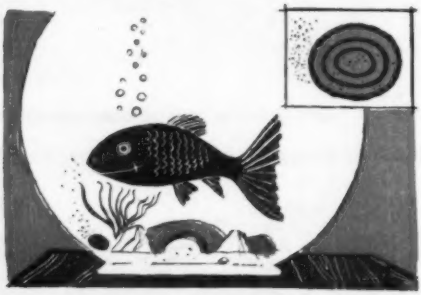
A CURRENT METER to measure the electricity any appliance uses in a given period. You'd connect it to the appliance and plug it into the outlet. —*P. M. Henson, Joplin, Mo.*

A PULL-OUT AUTO EXTENSION CORD with appropriate connections inside the car. To run an engine heater or charge the battery, you'd plug the cord into an outlet.—*E. E. Frazer, Kewanee, Ill.*



FURNITURE LOCKS to keep sectional couches from sliding apart. A metal plate, to slip over pins on each section or clamp into place, would do it.—*W. H. Tapscott, Port Arthur, Tex.*

A DISPOSABLE TOOTHBRUSH of tough paper or flexible plastic with plastic bristles. Tubular to fit over the index finger, it would need no handle.—*S. S. Smith, Oak Park, Mich.*



AUTOMATICALLY DISPENSED FISH FOOD so fish fanciers could get away for a weekend. Capsules within capsules would dissolve, one every 24 hours.—*Verda Ross, San Bernardino, Cal.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

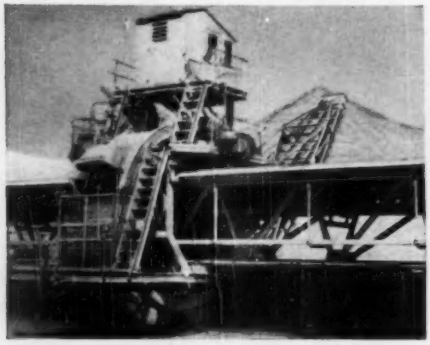
SPACE JIGSAW PUZZLE SPANS THE EARTH

Hundreds of photographs taken 800 miles up form this mosaic of half the earth's surface. They were cut and fitted together by GE space technicians from film recovered from the re-entry capsule of an Air Force Atlas missile. The capsule also contained stored information telemetered to the ground during the flight.

FLYING ANTENNA. The helium-filled blimp above carries a radio antenna 55 feet aloft. It was developed by Avco for use by downed planes. Released by the pilot or jarred free by a crash, it sends a rescue call several thousand miles.

GROUND CONNECTION. A phone on the end of a long rod is lifted to the cockpit of Marine planes at Cherry Point, N. C. A pilot can then talk to the control tower without radio interference and get his flight plan without delay.

MARINE TANK TRAINER. This tank turret, stripped of its armor, fires electronic shells to give Leatherneck tankers gun practice. Approaching tanks (circled in the photo) are shown in simulated battle conditions on photographic slides. The trainer shoots six shells a minute, its hits or misses registering on an electronic console. It was built by the Jim Handy Organization, Detroit.



BIG MIXER. A giant wheel as tall as a three-story building blends bulk materials at a cement plant at Oro Grande, Cal. Two-ton buckets on its rim pick up from a stockpile, dump onto a conveyor. Hewitt-Robins built the big machine.

LIGHTNING BUG. The bug-eyed plane above is a two-seat trainer version of Britain's supersonic Electric P-11 Lightning, a single-seat, all-weather interceptor. Two Firestreak guided missiles are at the sides of the fuselage.

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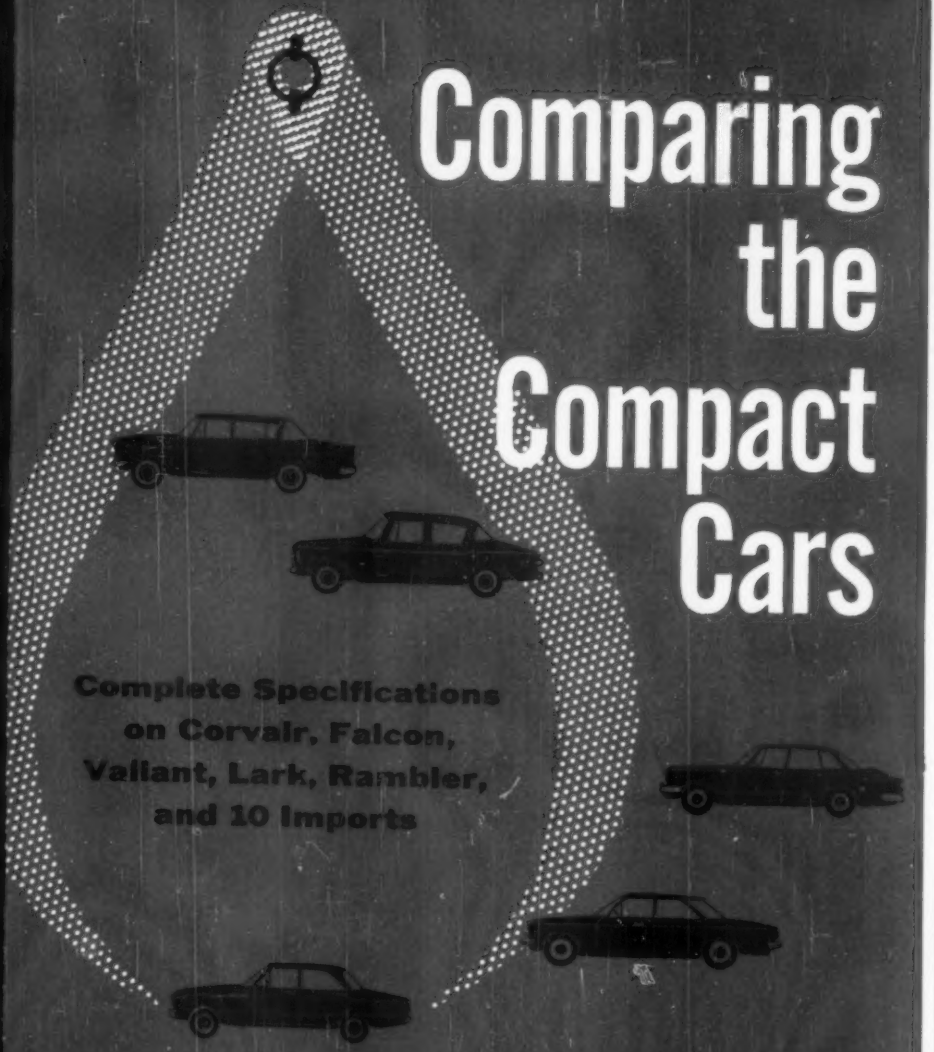
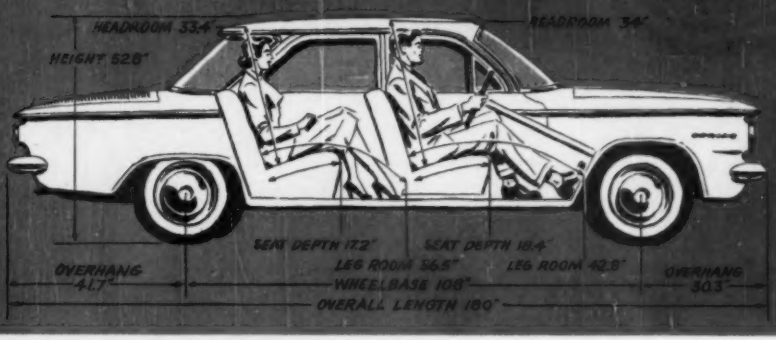
Comparing the Compact Cars



Complete Specifications on Corvair, Falcon, Valiant, Lark, Rambler, and 10 Imports

CORVAIR Base Price $2,038



Performance (estimated)

Top speed	85 m.p.h.
Acceleration, manual transmission:	
Zero to 30 m.p.h.	5.5 sec.
Zero to 60 m.p.h.	19.5 sec.
40 to 60 m.p.h.	10.5 sec.
Acceleration, automatic transmission:	
Zero to 30 m.p.h.	5.9 sec.
Zero to 60 m.p.h.	22.5 sec.
40 to 60 m.p.h.	11.0 sec.
Standing quarter-mile:	
Manual transmission	21.7 sec.
Automatic transmission	23.0 sec.
Fuel consumption, manual transmission:	
City	23 m.p.g.
Country	27 m.p.g.
Fuel consumption, automatic transmission:	
City	21 m.p.g.
Country	26 m.p.g.

Engine

Horsepower	80 @ 4,400 r.p.m.
Torque	125 lb.-ft. @ 2,400 r.p.m.
Displacement	140 cu. in.
Horsepower per cu. in.	0.57
Car weight per horsepower	30.2 lb.
Bore and stroke	3.38 x 2.60 in.
Air cooling	Belt-driven centrifugal blower
Valve lifters	Hydraulic
Pistons	Cast aluminum
Compression ratio	8:1
Fuel requirement	Regular
Engine revolutions per mile	3,030
Piston travel per mile	1,310 ft.

Transmission

MANUAL SHIFT

Clutch	Dry disk
Clutch effective area	71.8 sq. in.
Shift location	Floor, center
Gear ratios:	
In first	3.22:1
In second	1.84:1
In third	1.00:1
Rear-axle ratio	3.55:1
Optional rear-axle ratio	3.89:1

AUTOMATIC SHIFT

Type	PowerGlide torque converter
Gear ratios:	
In Low	1.82:1
In Drive	1.82:1, 1.00:1
Maximum torque multiplication at stall	2.6:1
Rear-axle ratio	3.55:1
Optional rear-axle ratio	None
Type of drive	Rear wheels driven independently through U joints

Steering

Gear ratio:	
Manual	23.5:1
Power	Not offered
Turning-circle diameter	39 ft.
Total turns, lock-to-lock	5

Brakes

Effective lining area	120.8 sq. in.
Weight per square inch	20 lb.
Lining	Bonded asbestos composition
Parking brake	Lever, driver's left

Tires

Size	6.50x13
Type	4-ply rayon cord
Pressure:	
Front	15 p.s.i.
Rear	26 p.s.i.

Suspension

Front	Independent ball joints, coil springs
Rear	Independent swing type, coil springs
Shock absorbers	Direct, double acting
Chassis type	Unitized

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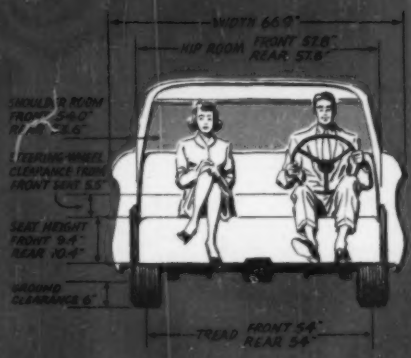


Dimensions and Capacities

WEIGHT (curb)
- Front ..... 935 lb.
- Rear ..... 1,480 lb.
- Total ..... 2,415 lb.

FUEL SYSTEM
- Tank capacity ..... 11 gal.
- Filler location ..... Front left fender
- Fuel filter ..... Sintered bronze
- Air cleaner ..... Oil-wetted

LUBRICATION SYSTEM
- Crankcase capacity ..... 4 qt.
- Oil filter ..... Full-flow, replaceable element

COOLING SYSTEM—Air-cooled

TRUNK
- Usable capacity, front (SAE) ..... 4.2 cu. ft.
- Width (top) ..... 49 in.
- Height (center front) ..... 19 in.
- Additional capacity behind rear seat 2.2 cu. ft.
- With optional folding seat down, usable capacity inside car is 15.8 cu. ft.

Electrical System

- Battery voltage ..... 12 volts
- Battery capacity ..... 35 amp.-hr.
- Number of plates 42
- Optional heavy-duty battery ..... 54-plate, 40 amp.-hr.
- Generator ..... 30 amp.

Standard Equipment

- Safety plate glass all windows
- Dual headlamps
- Electric windshield wipers
- Acrylic-lacquer finish
- Dome light, dash-controlled
- Sun visor (left side only)
- Ashtray (front only)
- Upholstery: Gray nylon-faced cloth on seats, grained vinyl on sidewalls, cloth headlining
- Full-flow oil filter
- Oil cooler
- Oil-wetted air cleaner

Optional Equipment

(Prices include factory installation and federal excise tax, but not state or local taxes)

- Automatic transmission $145.80
- Heater-defroster (gasoline-fired) 74.25
- Radio and antenna 53.80
- Whitewall tires (add'l charge) 20.95
- Wheel trim rings 10.80
- Folding rear seat 32.30
- Heavy-duty battery (add'l charge) 3.25
- Padded dash 18.30
- Two-tone finish 10.80
- Deluxe body-equipment group 10.00
  (Includes: right-hand sun visor, cigarette lighter, front armrests)
- Comfort-convenience group 32.30
  (Includes: outside rear-view mirror, windshield washer, back-up lights, glove-compartment light)

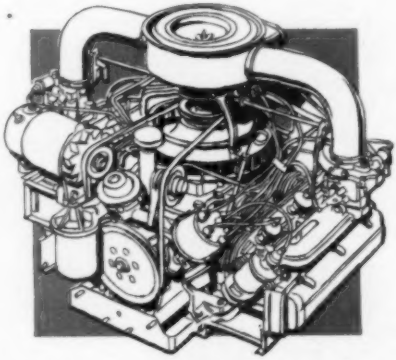
Prices

(Including federal excise tax and preparation and handling charges, but no other taxes or shipping charges)

Corvair 500:
- 4-door sedan $2,038
- 2-door coupe 1,984

Corvair 700:
- 4-door sedan 2,103
- 2-door coupe 2,049

The two series are identical except for fittings. 700 series includes, as standard equipment: dual horns, door-actuated light switches, deluxe upholstery in choice of three colors, chrome trim on exterior.



Basic engine: Horizontally opposed OHV six

FALCON Base Price $1,974

Performance (estimated)

Top speed	87 m.p.h.
Acceleration, manual transmission:	
Zero to 30 m.p.h.	4.8 sec.
Zero to 60 m.p.h.	18.0 sec.
40 to 60 m.p.h.	9.4 sec.
Acceleration, automatic transmission:	
Zero to 30 m.p.h.	5.0 sec.
Zero to 60 m.p.h.	22.0 sec.
40 to 60 m.p.h.	10.0 sec.
Standing quarter-mile:	
Manual transmission	21.3 sec.
Automatic transmission	22.8 sec.
Fuel consumption, manual transmission:	
City	24 m.p.g.
Country	30 m.p.g.
Fuel consumption, automatic transmission:	
City	21 m.p.g.
Country	30 m.p.g.

Engine

Horsepower	90 @ 4,200 r.p.m.
Torque	138 lb-ft. @ 2,000 r.p.m.
Displacement	144.3 cu. in.
Horsepower per cu. in.	0.62
Car weight per horsepower	26.6 lb.
Bore and stroke	3.50 x 2.50 in.
Valve lifters	Mechanical
Cylinder head	Cast iron
Pistons	Solid-skirt, tin-plated aluminum alloy
Compression ratio	8.7:1
Fuel requirement	Regular
Engine revolutions per mile	2,780
Piston travel per mile	1,160 ft.

Transmission

MANUAL SHIFT

Clutch	Dry disk
Clutch effective area	68.1 sq. in.
Shift location	Steering-wheel column
Gear ratios:	
In first	3.29:1
In second	1.75:1
In third	1.00:1
Rear-axle ratio	3.10:1
Optional rear-axle ratio	3.56:1

AUTOMATIC SHIFT

Type	Fordomatic torque converter with planetary gears
Gear ratios:	
In Low	1.75:1
In Drive	1.75:1, 1.00:1
Rear-axle ratio	3.10:1
Optional rear-axle	3.56:1
Type of drive	Hotchkiss

Steering

Gear ratio:	
Manual	27.0:1
Power	not offered
Turning-circle diameter	38.8 ft.
Total turns, lock-to-lock, manual	4.6

Brakes

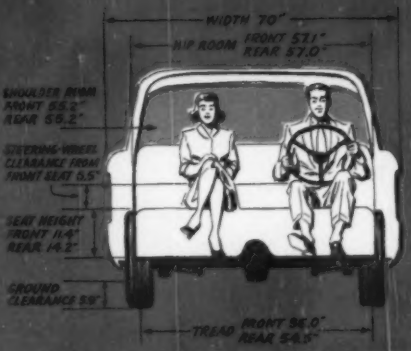
Effective lining area	114.3 sq. in.
Weight per square inch	21.0 lb.
Lining	Molded asbestos, riveted
Parking brake	T handle, driver's left

Tires

Size	6.00 x 13
Type	4-ply rayon cord
Pressure:	
Front	24 p.s.i.
Rear	24 p.s.i.

Suspension

Front ... Ball joint with pivoted top-mounted coil springs and link-type ride stabilizer



Dimensions and Capacities

WEIGHT (curb)
- Front ..... 1,287 lb.
- Rear ..... 1,108 lb.
- Total ..... 2,395 lb.

FUEL SYSTEM
- Tank capacity ..... 14 gal.
- Filler location ..... Rear center
- Fuel filter ..... Plastic and paper
- Air cleaner ..... Dry, replaceable paper element

LUBRICATION SYSTEM
- Crankcase capacity ..... 3.5 qt.
- Oil filter ..... Full flow

COOLING SYSTEM
- With heater ..... 9.3 qt.
- Without heater ..... 8.7 qt.

TRUNK
- Usable capacity (SAE) ..... 9.2 cu. ft.
- Width (top) ..... 44.5 in.
- Height (inside) ..... 17.2 in.

- Rear ..... Longitudinal leaf
- Shock absorbers ..... Direct acting
- Chassis type ..... Unitized

Electrical System

- Battery voltage ..... 12 volts
- Battery capacity ..... 40 amp.-hr.
- Number of plates 54
- Generator ..... 27 amp.

Standard Equipment

- Single headlamps
- Safety glass all windows
- Vacuum windshield wipers
- Dome light, dash-controlled
- Two sun visors
- Armrests (front only)
- Ashtray (front only)
- Upholstery: Gray vinyl and nylon cloth
- Full-flow oil filter
- Foam seat padding
- Zinc-clad underbody coating

Optional Equipment

(Prices include factory installation and federal excise tax, but not state or local taxes)

Automatic transmission	$159.40
Heater-defroster	67.80
Radio and antenna	54.05
Heavy-duty battery	7.60
Whitewall tires (add'l charge)	28.70
Padded dash and visors	19.20
Seat belts (front)	20.60
Two-tone finish	16.80
Tinted windshield	9.00
Wheel trim rings	16.00
Windshield washers	13.70
Electric windshield wipers	9.65
Deluxe trim	65.80

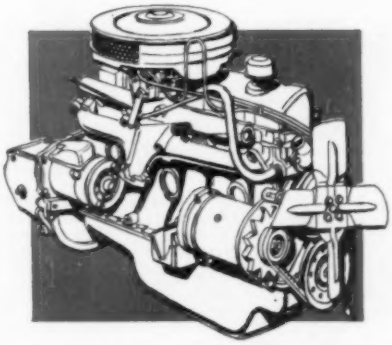
(Includes: bright-metal window trim and tail-light rings, automatic light switches, white steering wheel with horn rim, rear armrests, cigarette lighter, rear ashtray, deluxe upholstery)

Prices

(Including federal excise tax and preparation and handling charges, but no other taxes or shipping charges)

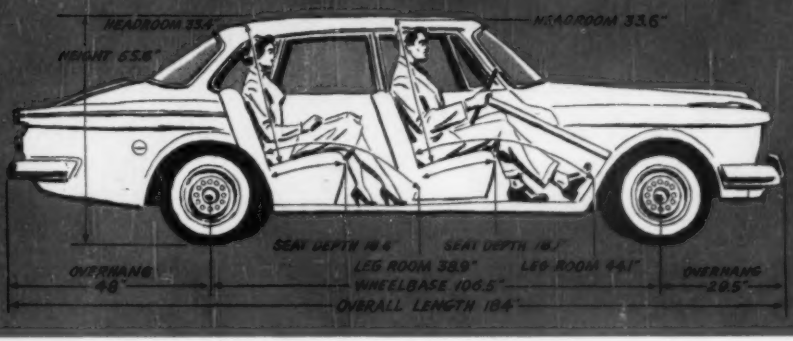
Four-door sedan	$1,974
Two-door sedan	1,912

(Other body styles or series not presently offered)



Basic engine: In-line OHV six

VALIANT Base Price $2,053



Performance (estimated)

Top speed	93 m.p.h.
Acceleration, manual transmission:	
Zero to 30 m.p.h.	4.6 sec.
Zero to 60 m.p.h.	16.0 sec.
40 to 60 m.p.h.	9.1 sec.
Acceleration, automatic transmission:	
Zero to 30 m.p.h.	4.8 sec.
Zero to 60 m.p.h.	17.5 sec.
40 to 60 m.p.h.	9.4 sec.
Standing quarter-mile:	
Manual transmission	20.8 sec.
Automatic transmission	21.9 sec.
Fuel consumption, manual transmission:	
City	22 m.p.g.
Country	29 m.p.g.
Fuel consumption, automatic transmission:	
City	21 m.p.g.
Country	29 m.p.g.

Engine

Horsepower	101 @ 4,400 r.p.m.
Torque	155 lb.-ft. @ 2,400 r.p.m.
Displacement	170 cu. in.
Horsepower per cu. in.	0.59
Car weight per horsepower	27.2 lb.
Bore and stroke	3.40 x 3.13 in.
Valve lifters	Mechanical
Pistons	Elliptically turned tin-plated aluminum alloy
Compression ratio	8.5:1
Fuel requirement	Regular
Engine revolutions per mile	3,040
Piston travel per mile	1,590 ft.

Transmission

MANUAL

Clutch	Dry disk
Clutch effective area	71.8 sq. in.
Shift location	Floor, center
Gear ratios:	
In first	2.71:1
In second	1.83:1
In third	1.00:1
Rear-axle ratio	3.55:1

AUTOMATIC

Type	Torque converter with gears
Gear ratios:	
In Low	2.45:1
In Drive-1	2.45:1, 1.45:1
In Drive-2	2.45:1, 1.45:1, 1.00:1
Maximum torque multiplication at stall	2.25
Rear-axle ratio	3.55:1
Optional rear-axle	3.23:1
Type of drive	Hotchkiss

Steering

Gear ratio:	
Manual	23.8:1
Power	18.7:1
Turning-circle diameter	37.1 ft.
Total turns, lock-to-lock:	
Manual	4.5
Power	3.5

Brakes

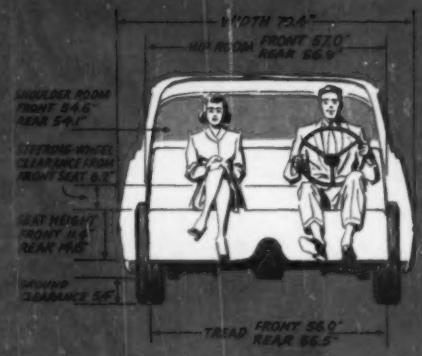
Effective lining area	129.1 sq. in.
Weight per square inch	21.3 lb.
Lining	Molded asbestos, riveted
Parking brake	Pedal, hand-released

Tires

Size	6.50 x 13
Type	4-ply rayon cord
Pressure:	
Front	24 p.s.i.
Rear	24 p.s.i.

Suspension

Front	Independent, lateral, non-parallel control arms with torsion bars



Dimensions and Capacities

WEIGHT (curb)
- Front ..... 1,510 lb.
- Rear ..... 1,236 lb.
- Total ..... 2,746 lb.

FUEL SYSTEM
- Tank capacity ..... 13 gal.
- Filler location ..... Left rear side
- Fuel filter ..... Plastic
- Air cleaner ..... Replaceable paper element

LUBRICATION SYSTEM
- Crankcase capacity ..... 4 qt.
- Oil filter ..... Full flow

COOLING SYSTEM
- Capacity:
  - With heater ..... 14 qt.
  - Without heater ..... 13 qt.

TRUNK
- Usable capacity (SAE) ..... 13.5 cu. ft.
- Width (top) ..... 47.3 in.
- Height (center) ..... 13.7 in.

- Rear ..... Parallel longitudinal leaf
- Shock absorbers ..... Direct acting
- Chassis type ..... Unitized

Electrical System

- Battery voltage ..... 12 volts
- Battery capacity ..... 50 amp.-hr.
- Number of plates 54
- Generator (alternating current) ..... 35 amp.
- Rectifier ..... 6 Silicon diode

Standard Equipment

- Dual headlamps
- Electric windshield wipers
- Dual horns
- Dome light, dash-controlled
- Sun visor (left side only)
- Full-flow oil filter
- Bright metal trim around windshield and back-light
- Fake Continental tire on trunk lid
- Glove-box lock

Optional Equipment

(Prices include factory installation and federal excise tax, but not state or local taxes)

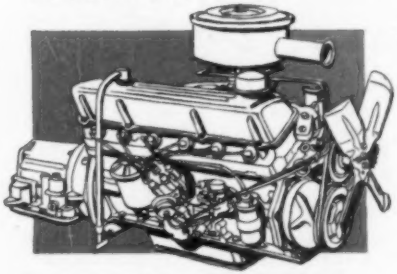
Automatic transmission	$171.55
Power steering	73.00
Power brakes	40.60
Heater-defroster	74.40
Pushbutton radio	58.50
Whitewall tires (add'l charge)	29.10
Variable-speed windshield wipers	5.05
Windshield washers	11.80
Back-up lights	10.70
Tinted windows	36.95
Wheel-trim rings	12.10
Padded dash	12.85
Padded visors (2)	10.05
Outside rear-view mirror	5.05
Prismatic rear-view mirror	5.05
Deluxe trim (V-200 series only) (includes: deluxe steering wheel with horn ring, stainless door and window moldings, carpeting)	$ 29.85

Prices

(Including federal excise tax and preparation and handling charges, but no other taxes or shipping charges)

Valiant V-100:	
Four-door sedan	$2,053
Four-door station wagon, 2-seat	2,365
Four-door station wagon, 3-seat	2,488
Valiant V-200	
Four-door sedan	$2,130
Four-door station wagon, 2-seat	2,443
Four-door station wagon, 3-seat	2,566

(The two series are identical except for fittings. V-200 series includes, as standard equipment: two visors, four armrests, lighter, automatic light switch, bumper guards, rub rail, deluxe interior trim.)



Basic engine: 30°-inclined in-line OHV 6

LARK 6 Base Price $2,046

Performance (estimated)

Top speed ..... 80 m.p.h.
Acceleration, manual transmission:
- Zero to 30 m.p.h. ..... 5.9 sec.
- Zero to 60 m.p.h. ..... 20.0 sec.
- 40 to 60 m.p.h. ..... 10.0 sec.

Acceleration, automatic transmission:
- Zero to 30 m.p.h. ..... 6.3 sec.
- Zero to 60 m.p.h. ..... 22.5 sec.
- 40 to 60 m.p.h. ..... 10.3 sec.

Standing quarter-mile ..... 23.1 sec. (25.2 sec. automatic)
Fuel consumption, manual transmission:
- City ..... 21 m.p.g.
- Country ..... 28 m.p.g.

Fuel consumption, automatic transmission:
- City ..... 19 m.p.g.
- Country ..... 27 m.p.g.

Engine

Horsepower ..... 90 @ 4,000 r.p.m.
Torque ..... 145 lb.-ft. @ 2,000 r.p.m.
Displacement ..... 169.6 cu. in.
Horsepower per cu. in. 0.53
Car weight per horsepower 30.4
Bore and stroke ..... 3.0 x 4.0 in.
Valve lifters ..... Mechanical
Pistons ..... Tin-plated aluminum
Compression ratio ..... 8.3:1, 7.0:1 optional
Engine revolutions per mile 2,970
Piston travel per mile ..... 1,980 ft.

Transmission

MANUAL

Clutch ..... Dry disk, 55.2 sq. in. (eff.)
Shift location ..... Steering-wheel column
Gear ratios:
- In first 2.61:1
- In second 1.63:1
- In third 1.00:1
- In fourth (optional) 0.70:1

Rear-axle ratio 3.73:1
- With overdrive 4.10:1

Optional rear-axle ratios 3.54:1, 4.10:1, 4.27:1, 4.56:1

AUTOMATIC

Type ..... Torque converter with gears
Gear ratios:
- In Low 2.40:1, 1.47:1
- In Drive 2.40:1, 1.47:1, 1.00:1

Maximum torque multiplication at stall 2.15
Rear-axle ratio 3.73:1
Optional rear-axle ratios 3.54:1, 4.10:1
Type of drive ..... Hotchkiss

Steering

Gear ratio:
- Manual 19.5:1
- Power (eights only) 24.5:1

Turning-circle diameter ..... 37.5 ft.
Total turns, lock-to-lock 5

Brakes

Effective lining area ..... 119.7 sq. in.
Weight per square inch 22.8
Lining ..... Molded asbestos, riveted
Parking brake ..... T handle, driver's right

Tires

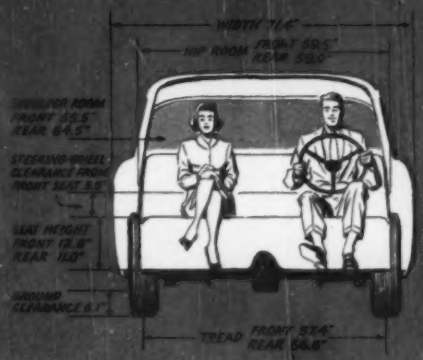
Size 5.90x15
Optional tires 6.40x15
Type ..... 4-ply rayon cord
Pressure ..... 24 p.s.i. front, 20 rear

Suspension

Front ..... Variable-rate coil springs
Rear ..... Semi-elliptical leaf springs
Shock absorber ..... Direct, double acting
Chassis type ..... Ladder frame

Electrical System

Battery voltage ..... 12 volts
Battery capacity ..... 50 amp.-hr.



Dimensions and Capacities

WEIGHT

Front	1,469 lb.
Rear	1,263 lb.
Total	2,732 lb.

FUEL SYSTEM

Tank capacity	18 gal.
Filler location	Rear panel
Fuel filter	Plasticized paper
Air cleaner	Dry plasticized paper

LUBRICATION SYSTEM

Crankcase capacity	5 qt.
Oil filter (extra cost)	Bypass

COOLING SYSTEM

Capacity:	
With heater	12 qt.
Without heater	11 qt.

TRUNK

Usable capacity (SAE)	12.6 cu. ft.
Width (top)	55.5 in.
Height (center)	27.5 in.

Number of plates	54
Generator	30 amp.

Standard Equipment

Single headlamps
Two-speed electric windshield wipers
Undercoating ("compulsory option" — furnished but charged for—$19.85)
Armrests (front doors only)
Stainless rubrail
Sun visor (left side only)
Ashtray (front only)
Automatic choke
Ignition-key starter switch

Optional Equipment

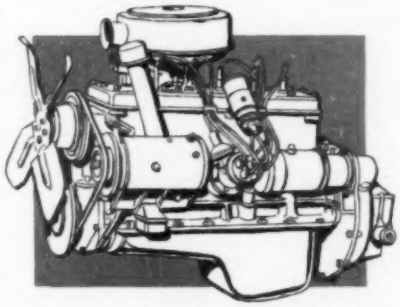
(Prices include factory installation and federal excise tax, but not state or local taxes)

Automatic transmission	$199.50
Overdrive	110.40
Power steering (eights only)	74.50
Power brakes	37.66
Heater-defroster	71.00
Air conditioner	325.00
Radio:	
Manual	56.64
Pushbutton	63.82
Signal-seeking	96.14
Whitewall tires	28.45
Wheel trim rings	15.95
Reclining front seats	47.43
Foam-rubber seat cushions	23.00
Padded dash	14.53
Padded sun visors	7.96
Accessory kit (Deluxe series) (Includes: automatic dome light, rear ashtray, right-hand sun visor, rear armrests, stainless window moldings)	35.75
Oil-wetted air cleaner	8.07
Oil filter	9.90
Limited-slip differential	38.93
Hill holder	15.06
Tinted windows	32.00
Windshield washer	11.95
V-8 engine (180 hp.)	135.00
Power kit (195 hp.) for V-8	44.95

Prices

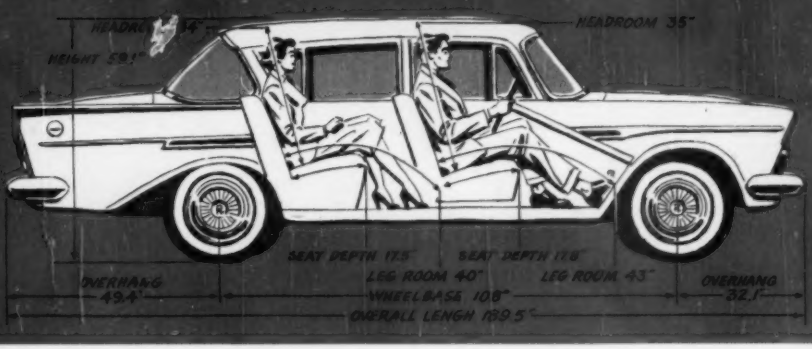
(Including federal excise tax and preparation and handling charges, but no other taxes or shipping charges)

Deluxe Series (6-cyl. engine):	
Four-door sedan	$2,046
Two-door sedan	1,976
Two-door station wagon	2,366
Four-door station wagon	2,441
Regal Series (6-cyl. engine):	
Four-door sedan	2,196
Two-door hardtop	2,296
Convertible	2,621
Four-door station wagon	2,591



Basic engine: In-line six, L-head

RAMBLER 6 Base Price $2,098



Dimensions and Capacities

WEIGHT (curb)
- Front ..... 1,656 lb.
- Rear ..... 1,382 lb.
- Total ..... 3,038 lb.

FUEL SYSTEM
- Tank capacity ..... 22 gal.
- Filler location ..... Left rear fender

LUBRICATION SYSTEM
- Crankcase capacity ..... 4.0 qt.
- Oil filter (optional) ..... Partial flow

COOLING SYSTEM
- Capacity:
  - With heater ..... 11.0 qt.
  - Without heater ..... 10.0 qt.

TRUNK
- Usable capacity (SAE) ..... 13.5 cu. ft.
- Width (top) ..... 52.4 in.
- Height (center) ..... 15.5 in.

Performance (estimated)

- Top speed ..... 90 m.p.h.
- Acceleration, manual transmission:
  - Zero to 60 m.p.h. ..... 18.0 sec.
  - 40 to 60 m.p.h. ..... 9.9 sec.
- Acceleration, automatic transmission:
  - Zero to 60 m.p.h. ..... 21.0 sec.
  - 40 to 60 m.p.h. ..... 10.2 sec.
- Fuel consumption, manual:
  - City ..... 20 m.p.g.
  - Country ..... 28 m.p.g.
- Fuel consumption, automatic:
  - City ..... 19 m.p.g.
  - Country ..... 28 m.p.g.

Engine

- Horsepower ..... 127 @ 4,200 r.p.m.
- Torque ..... 180 lb.-ft. @ 1,600 r.p.m.
- Displacement ..... 195.6 cu. in.
- Horsepower per cu. in. 0.65
- Car weight per horsepower ..... 23.9 lb.
- Bore and stroke ..... 3.13 x 4.25 in.
- Type ..... In-line six, OHV
- Compression ratio 8.7:1
- Fuel requirement ..... Regular
- Engine revolutions per mile 2,890
- Piston travel per mile ..... 2,050 ft.

Transmission

MANUAL SHIFT
- Clutch effective area ..... 72.2 sq. in.
- Heavy-duty clutch (optional) ..... 77.9 sq. in.
- Shift location ..... Steering-wheel column
- Gear ratios:
  - In first 2.61:1
  - In second 1.63:1
  - In third 1.00:1
- Rear-axle ratio 3.78:1 (4.11 or 4.38:1 optional)

AUTOMATIC SHIFT
- Type ..... Flash-O-Matic torque converter with planetary gears
- Gear ratios:
  - In Low 2.40:1
  - In Drive-1 ..... 2.40:1, 1.47:1, 1.00:1
  - In Drive-2 ..... 1.47:1, 1.00:1
- Maximum torque multiplication at stall 2.12:1
- Rear-axle ratio ..... 3.31:1, 3.78:1 optional
- Type of drive ..... Torque tube

Steering

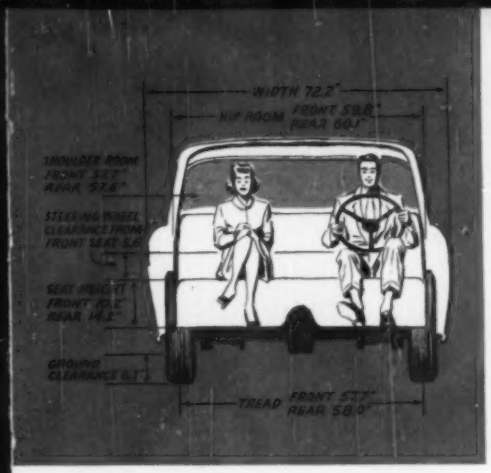
- Gear ratio ..... 23.0:1 (18.6:1 power)
- Turns, lock-to-lock ..... 4.7 (3.6 power)

Brakes

- Effective lining area ..... 136.3 sq. in.
- Weight per square inch ..... 19.7 lb.
- Parking brake ..... Pedal, driver's left

Suspension

- Front and rear ..... Coil springs
- Chassis type ..... Unitized



AMERICAN
Base Price $1,844

Dimensions
Wheelbase ..... 100.00 in.
Overall length ..... 178.3 in.
Width ..... 73.0 in.
Curb weight ..... 2,614 lb.
Leg room ..... 44.0 in. front, 37.5 in. rear
Head room ..... 35.3 in. front, 34.0 in. rear
Hip room ..... 58.0 in. front, 45.3 in. rear
Shoulder room ..... 51.5 in. front, 49.8 in. rear

Performance
Top speed ..... 85 m.p.h.
Acceleration, zero to 60 m.p.h
Manual ..... 18.5 sec.
Automatic ..... 21.6 sec.
Fuel consumption, manual, City ..... 22 m.p.g.
Country ..... 28 m.p.g.
Fuel consumption, automatic, City ..... 20 m.p.g.
Country ..... 28 m.p.g.

Engine
Horsepower ..... 90 @ 3,800 r.p.m.
Torque ..... 150 @ 1,600 r.p.m.
Displacement ..... 195.6 cu. in.
Horsepower per cu. in. 0.46
Car weight per horsepower ..... 29.0 lb.
Bore and stroke ..... 3.13 x 4.25 in.
Type ..... In-line six, L-head
Compression ratio 8.0:1

Running Gear
Chassis type ..... Unitized
Weight per sq. in. of brake-lining ..... 18.7 lb.
Steering-gear ratio ..... 22.0:1, (17.5:1 power)
Turning-circle diameter ..... 35.6 ft.
Rear-axle ratios:
Manual ..... 3.31:1, 3.78:1 optional
Overdrive ..... 3.78:1, 4.11:1 optional
Automatic 3.31:1
Automatic transmission ..... Torque converter with planetary gears

Prices and Equipment
(Including federal excise tax and preparation and handling charges, but no other taxes or shipping charges)

Deluxe Series
Four-door sedan $1,844
Two-door sedan 1,795
Two-door station wagon 2,020

Super Series
Four-door sedan 1,929
Two-door sedan 1,880
Two-door station wagon 2,105

Optional Extras
Automatic transmission $178.50
Overdrive 102.00
Power steering 69.50
Heater-defroster 72.00
Radio and antenna 57.70
Reclining seat 14.65
Self-adjusting brakes 7.45

Electrical System
Battery ..... 12 volts, 45 amp.-hr., 42 plates
Generator ..... 25 amp.

Standard Equipment
Single headlamps
Sun visor (left side only)
Twin ashtrays (front only)
Ignition-key starter switch

Optional Equipment
(Prices include factory installation and federal excise tax, but not state or local taxes)
Automatic transmission $199.50
Overdrive 112.50
Power steering 69.50
Power brakes 37.95
Heater-defroster 76.00
Air conditioner 369.00
Radio and antenna 75.65
Reclining seat 25.50
V-8 engine (200 hp., Super and Custom) 119.00
Power kit, six-cylinder (138 hp.) 19.50
eight-cylinder (215 hp.) 37.50

Prices
(Including federal excise tax and preparation and handling charges, but no other taxes or shipping charges)

Deluxe Series (6-cyl. engine)
Four-door sedan $2,098
Four-door station wagon, 2-seat 2,427

Super Series (6-cyl. engine)
Four-door sedan 2,268
Four-door station wagon, 2-seat 2,562
Four-door station wagon, 3-seat 2,687

Custom Series (6-cyl. engine)
Four-door sedan 2,383
Four-door hardtop 2,458
Four-door station wagon, 2-seat 2,677
Four-door station wagon, 3-seat 2,802

Comparing the Compact Cars: The Top 10 Imports

MAKE			VOLKS-WAGEN	RENAULT DAUPHINE	FORD ANGLIA	OPEL REKORD	SIMCA ELYSEE	FIAT 600	HILLMAN MINX	TRIUMPH	VAUXHALL VICTOR	VOLVO PV544
PRICE			$1,565[a]	$1,645[a]	$1,583	$1,988[a]	$1,898[a]	$1,398[a]	$1,735	$1,699	$1,813[a]	$2,342[a]
MODEL (sedan)			2 door	4 door	2 door	2 door	4 door	2 door	4 door	4 door	4 door	2 door
WHEELBASE (in.)			94.5	89.0	90.5	100.0	96.3	78.8	96.0	84.0	98.0	102.5
OVERALL LENGTH (in.)			160.2	155.0	153.5	174.5	165.6	130.5	162.0	144.0	167.7	177.0
WIDTH (in.)			60.6	60.0	57.3	63.6	61.9	54.3	60.8	60.0	63.5	62.5
CURB WEIGHT (lb.)			1,600	1,397	1,625	2,006	2,053	1,350	2,187	1,525	2,200	2,140
ENGINE	TYPE (all OHV 4-cyl.)		opposed	in-line	in-line	in-line	in-line	in-line	in-line	in-line	in-line	in-line
	LOCATION		rear	rear	front	front	front	rear	front	front	front	front
	DISPLACEMENT (cu. in.)		72.7	51.5	61.0	90.8	78.7	38.6	91.2	57.8	92.0	97.0
	HORSEPOWER @ R.P.M.		36@3,700	32@4,200	41@5,000	57@4,400	48@4,800	24.5@4,600	56.5@4,600	40@5,000	55@4,200	85@5,500
	WEIGHT PER HP. (lb.)		44.5	43.6	39.6	35.1	42.7	55.1	38.8	38.2	40.0	25.2
	TORQUE (lb.-ft. @ r.p.m.)		48@2,000	44@2,100	56@2,700	84@2,400	65@2,800	27@2,750	83@2,000	50@2,700	85@2,400	87@3,500
	COMPRESSION RATIO (to 1)		6.6	8.0	8.9	7.8	6.8	7.5	8.5	8.0	7.8	8.2
TIRE SIZE			5.60x15	5.00x15	5.20x13	5.90x13	5.60x14	5.20x12	5.60x15	5.20x13	5.60x13	5.90x15
TURNING-CIRCLE DIAMETER (ft.)			36.0	30.0	32.0	35.1	35.2	28.5	36.0	32.0	34.0	35.5
WT. PER. SQ. IN. OF BRAKE AREA (lb.)			14.9	17.0	21.2	18.4	15.1	20.0	23.8	22.4	23.9	13.6
DIMENSIONS	SHOULDER ROOM (in.)	Front	b	b	b	49.2	47.2	b	52.5	b	46.8	b
		Rear	50.8	46.8	43.8	49.2	46.1	44.0	50.0	44.0	47.3	48.7
	HEAD ROOM (in.)	Front	37.5	35.0	38.1	36.0	34.2	36.2	37.8	38.0	35.5	39.0
		Rear	34.8	35.5	37.0	34.8	34.0	33.6	36.8	35.0	35.8	34.0
	HIP ROOM (in.)	Front	b	b	b	52.8	50.8	b	47.0	b	51.6	b
		Rear	52.0	50.0	43.0	53.1	49.8	48.0	45.5	39.0	52.0	51.2
	LEG ROOM (in.)	Front	44.5	43.0	46.0	43.4	40.0	35.4	35.5	41.5	43.0	42.0
		Rear	38.0	37.5	40.4	39.4	38.6	35.8	43.8	37.0	39.7	41.0
ACCELERATION (sec.) 0-50 m.p.h.			18.9	19.3	n.a.	15.8	13.9	39.4	n.a.	19.1	19.4	10.0
TOP SPEED (m.p.h.)			70	72	70	78	76	60	80	75	75	95
GAS MILEAGE (m.p.g.)			35	35	30	25	30	35	25	35	30	25

Notes: Prices include delivery at East Coast port and federal excise tax but no other shipping charges or taxes; n.a., information not available; [a]Price includes heater; [b]Twin seats.

SPECIAL SECTION

1960 An Exciting Year for Automobiles

The Year of the Small Car opened with a bang. Customers clamored to sign contracts, even offering under-the-table bonuses to get immediate delivery. The U.S. was in love with automobiles again.

In this issue, POPULAR SCIENCE shows you what all the shouting's about. Here's the whole story of cars in 1960—small cars, big cars, and in-between cars.

• **Compact cars.** They're the exciting news. The tear-out booklet at left crams 11 pages with the significant details on all six U. S. makes and the top 10 imports. You'll find everything you need to know from seat height and trunk space to gear ratios and gasoline mileage. There's a complete price list covering all series, all models, and most optional equipment. (To remove booklet, place your left hand on page preceding booklet, then pull it gently away with your right.)

• **What's it like to own a Corvair?** PS editors drove one 10,000 miles in one month to find out for you. Turn the page for their reports from the driver's seat.

• **Safety.** It almost got lost in Detroit this year. In his annual going-over, expert Paul Kearney tells you how car makers, while introducing some worthwhile safeguards, muffed a rare chance to cut the accident toll. Page 119.

• **Foreign cars.** They're fighting back against the new U. S. competition with slicked-up styles and sharpened-up engineering. An on-the-spot report direct from the Continent details the changes.

• **Station wagons.** This body style continues to gain in popularity. Here, on page 126, is the 1960 crop in pictures and specifications.

• **Engineering.** Underneath the sheet metal in the 1960 models are mechanical innovations that the ballyhoo neglects to mention. Some are just cute tricks that make driving easier or more fun, but others are solid advances to alleviate brake, ignition, and muffler ills. A roundup of the most interesting developments begins on page 129.

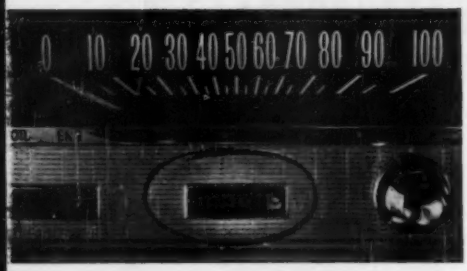
• **Tomorrow's car?** You may not ride on wheels at all. PS reporter Erik Arctander tells you how it feels to drive an air scooter with the seat of your pants. See page 134.

• **Accessories.** New gimmicks and gadgets are ready for your car. Page 136.

Testing the small rear-engine Chevy:

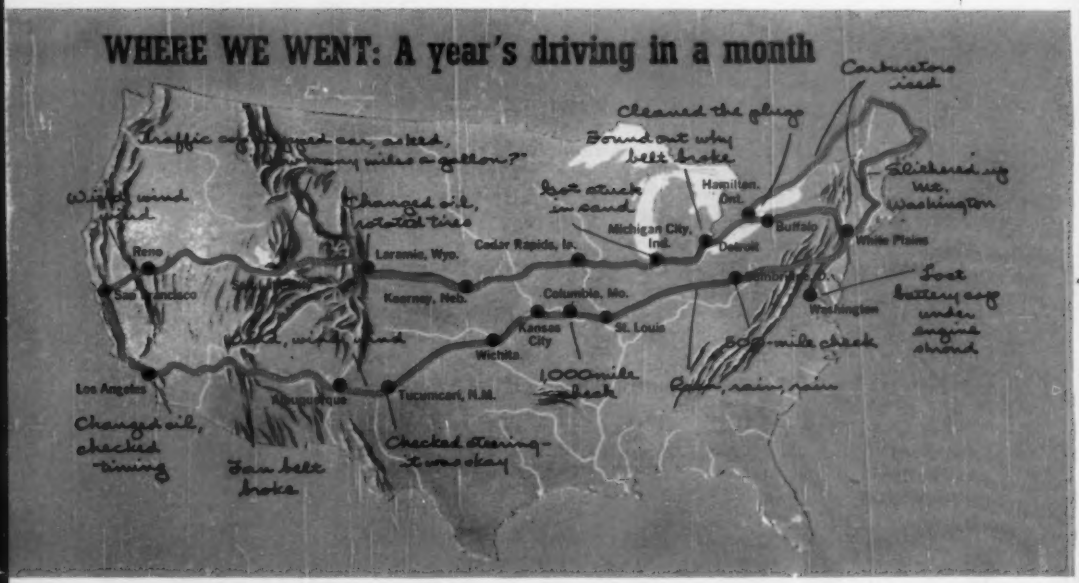
10,000 MILES IN A

At 10 a.m. on a Friday morning a few weeks ago, a staff member of POPULAR SCIENCE began a transcontinental drive in a Chevrolet Corvair—one of Detroit's new "compact" cars.



This marked a milestone in resourceful magazine reporting. The goal was 10,000 miles of test driving—as much driving as the average motorist does in a year—in just one month.

The test was no tour of a Detroit proving ground. It was a full-scale, intensive effort to find out for you everything possible about this spanking-new, rear-engine car.



CORVAIR

We wanted to tell you about its strengths and its weaknesses, its virtues and its faults, its running costs and its gasoline mileage.

The Corvair had been purchased by POPULAR SCIENCE from an authorized dealer at the full retail price.

In the next 30 days POPULAR SCIENCE reporters drove the Corvair . . . to Los Angeles, San Francisco, back to the East Coast, into New England, up into Canada's maritime provinces, back along the eastern seaboard and to Washington, D. C. They drove it over mountain and plain; in snow, in rain, in sunshine, in mud. They drove it on turnpikes and parkways, and through dense city traffic.

The article that follows, composed of separate reports by staff members, details what we discovered.

HOW THE CORVAIR DID

THE PERFORMANCE

Total distance covered	10,360 miles
Gasoline used (non-premium)	442.1 gal.
Average miles per gallon	23.43*
Oil burned	4 quarts
Gas mileage at constant speeds	
30 m.p.h.	26.6 m.p.g.
40 m.p.h.	24.2 m.p.g.
50 m.p.h.	23.6 m.p.g.
60 m.p.h.	22.6 m.p.g.
Gas mileage in stop-and-go driving	21 m.p.g.**
Acceleration	
0-60 m.p.h.	17 seconds
40-60 m.p.h.	12.8 seconds
50-70 m.p.h.	15 seconds

*For approximately 3,600 miles of the 10,360, operation of the gasoline-fired heater reduced the gas mileage by slightly more than two miles per gallon.

**With heater on.

Top speed	88 m.p.h.

Speedometer error

Indicated Speed	Actual Speed
40 m.p.h.	40 m.p.h.
50 m.p.h.	49 m.p.h.
60 m.p.h.	59 m.p.h.
70 m.p.h.	69 m.p.h.

THE COSTS

Gasoline		$148.71
Oil burned		2.09
Gas-oil cost per mile		.0145
Repair and maintenance, including adjustments at 500, 1,000, 5,000, and 10,000 miles		
Oil and filter changes	$9.00	
Lubrication	5.50	
Fan-belt replacement	3.05	
Total labor	21.95	
Total		39.50
Overall direct operating cost per mile		.0184

Curious farmers collected at Cunningham, Kan., to look at the engine of this new breed of car.

The altitude in Arizona did not bother the Corvair.

The Corvair Coast-to-Coast By Devon Francis

Distance	6,371.3 miles
Average gas mileage	22.6 m.p.h.
Best gas mileage	24.4 m.p.g.
Worst gas mileage	19.4 m.p.g.
Oil consumption	3 qt.
Repairs (and maintenance)	$30.15

THE Corvair is a shocker. Nothing like it has ever come off a U. S. production line in the 65-year history of the automobile.

It is built to be compact. It is. It is engineered to give a superb ride. It does. It is designed to be as flawless as collective wisdom could make it. It has its faults.

While the Corvair is being peddled by automobile agencies throughout the land as a housewife's go-to-market car, I was astonished by its roadability at 75 miles an hour.

I had my troubles with it.

I was tooling it along a western Arizona road at a comfortable 60 miles an hour on a sunny afternoon. The air-cooled engine was running like a sewing machine. I felt that in my accelerator toe. I couldn't hear it—the noise was hushed by an insulated compartment behind me.

Since leaving White Plains, N. Y., I had covered 2,500 miles. Except for a few minor annoyances, the car had been a perfect lady. This trip was going to be a breeze.

Suddenly a red light flashed in a little window on the instrument panel. Foreshortened warning words appeared: "GEN-FAN."

I switched off the ignition and wheeled off the road onto a knife-thin shoulder amid the desert's ocatilla bushes and tumbleweed.

"Trouble?" inquired my wife, beside me.

"Lots," I said.

The V belt, twisting and writhing like a snake in making its rounds of engine crankshaft, cooling fan, generator, and idler, had worn so badly that it had shed its pulley anchorages.

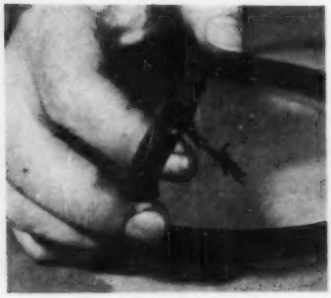
The owner's manual was beautifully explicit: "NEVER DRIVE CAR UNTIL BROKEN FAN BELT IS REPLACED." I carried no spare belt.

Help was 16 miles away. It was two hours and 20 minutes before a mechanic had installed a new belt and we were on our way again.

Then and there I decided that the belt drive was a weak link in the Corvair's engine design. Some weeks after that I was to revise my opinion. I will explain why later in this article.

The frayed belt was the first—and last—genuinely unhappy incident that I experienced with the car in more than 6,000 miles.

I found the Corvair an almost unqualified delight. My fellow drivers, of course, do not share all my opinions. Their views appear on later pages of this article.



Then the belt broke. Chewed up, useless, it was removed . . .

. . . and the car was subjected to the ultimate indignity of a tow to get a new belt installed.

The overall gas mileage for 10,360 miles is, however, a hard figure that nobody can quarrel with. That is reproduced at the opening of this article, along with the fuel economy in stop-and-go driving.

It is only fair to the car to emphasize that only one mile in each 20 that it was driven was slow city driving. Most of the mileage was run up on the open highway at the top legal speeds. These ranged from 40 miles an hour on the New York parkways, through 65 on the Ohio and Maine turnpikes, to 75 and 80 on the Nevada plateau. A few times the accelerator was floorboarded until the speedometer registered close to 90.

The gas mileage, naturally, was lowest for any given speed during the 3,000-mile engine break-in period. It varied, too, with individual driving habits and terrain.

The car's ride was like nothing I had ever experienced in a vehicle of sub-standard size. Chevy has done remarkable things with the springs and shocks on the four independently suspended wheels.

At day's end I was fresher than I have been in many standard-size, heavy cars. The exceptional quietness helped—it did, that is, when I got used to hearing things that normally are drowned out in the noise of front-end engines and transmissions.

[*Continued on page 208*]

How the Corvair's Tires Stood Up

After 10,360 miles, an expert measured the original-equipment 6.50 x 13 Firestone tires. His tread-wear gauge showed a 15-percent loss in tread depth on three tires. The fourth had a 10-percent loss and the fifth, worn unevenly, had a loss ranging from 10 to 15 percent. Each of these last two tires spent half the trip as a spare. At this rate, the expert estimated, the set would be worn smooth at approximately 60,000 miles.

How Well Was It Designed and Built?

For all its sparkle, the Corvair (like every car) has faults of design and assembly.

The fan belt should be tensioned with a spring scale. Most mechanics will not bother—they will do it by thumb pressure.

The dimmer switch is hard to reach.

Driver leg room is shy for six-footers.

The ratchet parking brake crashes on release.

With the sun at a certain height, the glossy-finished instrument panel top puts a blinding reflection in the windshield.

Hood edges on the panel are dangerously sharp.

The throws on the manual-shift transmission are too long.

Door locks cannot be checked visually.

Production-line assembly generally is good. Leaks, however, persisted around the windshield even after a resealing treatment. The wiring on the heater had to undergo surgery twice before it was cured.

City Manager Bundy (left) and Chevy dealer Hastings (right) greeted Francis in Santa Monica.

San Francisco: The Golden Gate Bridge was a must.

The Corvair in Weekend Traffic By Wesley S. Griswold

Distance	525.5 miles
Average gas mileage	24.9 m.p.g.
Best gas mileage	26.4 m.p.g.
Worst gas mileage	23.1 m.p.g.
Oil consumption	None
Repairs	None

I DROVE the Corvair 525.5 miles, from Santa Monica to San Francisco. Traffic was heavy (it was a holiday weekend). Weather was dry and windless.

I don't remember when I have been more enthusiastic about a new car. The Corvair is wonderfully maneuverable and responds nimbly to the accelerator. It rides as comfortably as a heavy car, and a very light touch on the steering wheel keeps it headed where you want it to go.

It seemed remarkably quiet to me. I got a sensation similar to that of riding up front in a jet airliner, with only a murmurous reminder that there is an engine pushing you.

The points I don't like about it are few but worth mentioning. The clutch seems stiff. Moreover, it is located too far to the right. At first I kept putting my left foot down on the empty floor and having to hunt for the clutch pedal. It is so far to the right of where you would expect it to be that using it tends to make the driver twist slightly, and uncomfortably, from a straight-ahead position. Since you have to use the clutch continually in city traffic, or on a heavily congested highway, this gets tiring. Perhaps the fact that I'm accustomed to an automatic transmission contributed to my feeling.

It seemed to me that the reflection of following headlights in both side-view and rear-view mirrors was exceptionally distracting. The only reason I could assign to this was that I was low enough to pick up the full blast of the low beam of following cars of normal height.

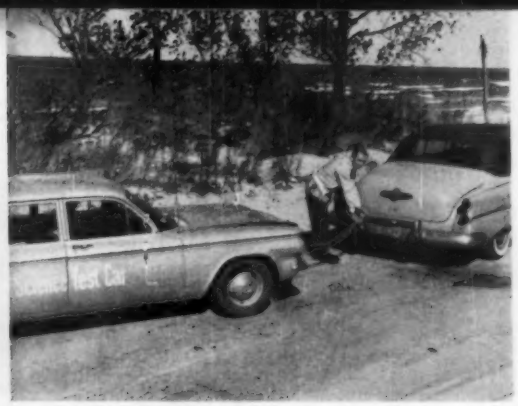
Happy on the hills. The Corvair is a dandy little hill climber. I took it over San Marcos Pass, just north of Santa Barbara, just to see how it would react to a climb from sea level to 2,225 feet in a fairly short space, and how it would take the multiple hairpin curves on the other side of the summit. I came up in high, sailed past a few poky standard cars, and breezed over the summit at 55 m.p.h.

Coming down, the Corvair took those incessant sharp curves as firmly and securely as if it had been riding rails. I couldn't detect even a slight tendency for the rear end to sway out.

It may have been a peculiarity of this particular car, but I repeatedly noticed that between 50 and 55 m.p.h.—just about at 52—I could feel a slight shake in the seat and in the steering wheel. In fact, I could see my hands on the steering wheel shudder. This quickly passed as I accelerated, however.

The final foible I noticed was an occasional hesitancy in power, especially

The tires were rotated at 5,000 miles in a stop at Laramie, Wyo.



A Good Samaritan, Manuel Galloza, freed the car when it bogged down in Lake Michigan sand.

on long downgrades, when I increased pressure on the accelerator. There seemed to be an instant's stumble or hiccough in the engine. Another thing I noticed, on the long, snaky descent from the summit of San Marcos Pass, was that in high gear the engine does not seem to provide braking effect.

On the asset side is the car's superb visibility, both front and rear. And, of course, it is almost as easy to park as a bicycle.

I found 50 m.p.h. to be its ideal cruising speed; its movement at that speed is a hushed, effortless glide.

But the Corvair is not made for tall men. I'm only 5 feet 10½ inches, which isn't much over average height, but even with the seat as far back as it would go, I couldn't really stretch my legs out in comfort. And it was annoying that just about the only place to put my feet without bending my knees was in a fairly narrow trough under the foot pedals.

A Housewife Looks at the Corvair

By Rosemary Francis

AFTER my husband and I returned from our trip in the Corvair—twice across the continent in 17 days—a friend asked me if it wasn't nervewracking to drive hour after hour, often at high speed, in a little, light car.

The fact is, this car has a good, solid, "heavy" feel. You sit low in it, and it has a reassuring close-to-the-road feeling, especially on curves. You won't believe the ride at first. It's as soft as a baby buggy's.

In the beginning I worried that drivers of bigger cars couldn't see me as I got ready to pass. I got over that—obviously they could. And the Corvair is easier to get into and out of than most "big" cars.

Inside, everything is so handy. The shelf above the dash is constructed so that nothing slides off. The lighter, ashtray and radio are at your fingertips.

It does seem to me, though, that the factory could call in a woman with some imagination to do something about the upholstery. It's pretty drab. But my biggest complaint was that I found it most difficult to reach back inside the car to lock the back doors.

So far as shopping goes, the Corvair is a housewife's dream. It's small and easily maneuvered without any power steering, and so easily parked. The trunk has plenty of space for a week's groceries. It's a lot easier to unload a cart full of groceries into a front trunk at the supermarket than it is into a rear one.

It's not easy, however, to load luggage into the trunk. Wheel wells, the spare wheel and the heater cut into the available space. We found that the trunk would take only one big traveling bag.

Styling, with a woman, is of course a sort of personal thing. I like the Corvair's. On our trip scores of women gave the little car a double-take and a big grin. A lot of other women obviously felt as I do—that the Corvair is a doll.

Turn the page for more about the Corvair

The car proved sure-footed in sleet and snow on Mount Washington, N. H.

The PS Corvair was nearing 10,000 miles when it reached the national capital.

The Corvair in Rough Going

By Frank Rowsome Jr.

Distance	2,267.1 miles
Average gas mileage	22.1 m.p.g.
Best gas mileage	25.6 m.p.h.
Worst gas mileage*	18.7 m.p.g.
Oil consumption	1 qt.
Repairs (tune-up)	$9.35

*This leg included climbing Mt. Washington, and involved 16 miles in low and second gear.

ON A boulevard all cars seem cream-puffs; on a narrow, winding road it is far easier to tell a good goer from a barge. After a friend of mine and I had wheeled the PS Corvair through northern New England and three Canadian provinces—on the kind of tooth-loosening back roads where a driver mentally apologizes to his car—we concluded:

- This is a driver's car—almost as much fun as a sports car.
- Both steering and handling are remarkable. Corvair is superb in the corners. Better, it is forgiving when you ask too much of it.
- On slippery going, in snow and ice, it bulls through as few cars, the Jeep excepted, have done in years.
- Many details of design and assembly cry to be improved.

On secondary roads, especially those curvy, dip-and-rise roads so often found where the land is rocky and the highway department impoverished, Corvair shines brilliantly. In fact if a road is bent enough, this little 80-hp. sedan, cornering with an eerie flatness, might well outrun *any* U. S. passenger car.

The ride is good, too, even on corduroy, gravel, railroad crossings, and potholes. One weakness we noted where occasional smooth-surfaced road billows were spaced about 12 feet apart. If taken fast these don't trouble the driver much—he has a wheel to hold—but his passenger posts briskly, like a society girl on a horse.

On snow and ice the Corvair is cat-footed. She can be skidded by harsh applications of power, brakes, or side loads. But we could detect no sly eagerness to go sideways or to swap ends.

Only once in more than 2,000 fast miles did she show the whites of her eyes for an instant. That was under extreme prov-

[*Continued on page 210*]

NEXT MONTH: *Don't miss the next of Popular Science's exhaustive, first-hand reports on Detroit's new compact cars—*

10,000 Miles in a Ford Falcon

By Paul W. Kearney

Paul Kearney's analysis of new models has long been a POPULAR SCIENCE *feature. An authority on highway safety, he recently won a first-prize Ted V. Rogers Journalism Award of $1,500 for "A Safety Expert Takes A Hard Look at Turnpikes," in PS, July, 1958.*

SAFETY: An Expert Takes a Critical Look at the '60 Cars

Ingenious new safety features show up in the new crop, but far too many needless hazards remain

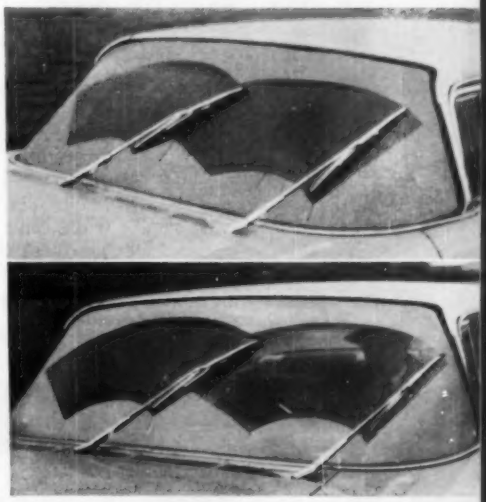
ALL three of the long-awaited compact cars are disappointing: Not one of them has a single fresh safety approach. Two have actually lost ground in details deemed far more important in the Cornell Crash Injury Research laboratories than in dealers' showrooms. With virgin products to work with, this reflects scant credit on Detroit.

True, their unanimous swing toward unit construction, featured for 20 years by Nash and American Motors, is a kind of advance. Structural solidity is further enhanced in Valiant and Corvair by the addition of roof bows for greater reinforcement against rollovers—so long ignored by manufacturers, if not by undertakers.

Inside the compacts the same safety features now expected in the standard models are available: impact-resistant door latches; the deep-dish steering wheel; and optional seat belts and crash padding. But none of the Big Three's junior cars has emulated the Lark's sensible padding of the lower edge of the dash.

The Valiant dash and instrument panel are clean. Unaccountably, the Falcon backslides to a nasty row of control buttons protruding from the lower edge of the center panel at about knee height. And the Corvair's arched molding of the dash in front of the right-seat passenger will be cruel to the chin or chest that hits it. In models that are starting from scratch in 1960, it is a pity to rummage back to the early 1950's for such hoary ideas.

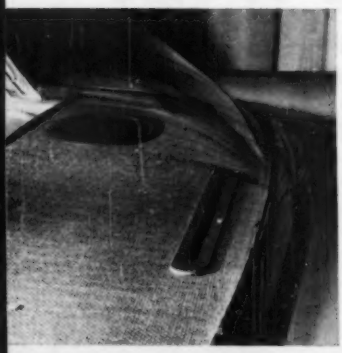
On a modest amount of test driving, these new compacts seemed to me surprisingly nimble, sure-footed, and re-



Hats off to Mercury for its tandem wipers, carried over from last year but upped to three speeds, and for its new eye-level spot defrosting system.

CONTINUED

Vacuum door lock actuated by a lever on the dash is a Chrysler feature, enabling driver to secure all doors before starting.



Something new and interesting on Chrysler's 1960 safety list is the automatic defroster for the rear window.

assuring to handle. There is an absence of small-car feel, even to one who just stepped out of a big car. Doubting Toms will have to await a volume of experience by compact-car buyers for confirmation or reassurance of their fears about the handling of a rear-engine compact. This experience will also show whether it was wise or foolish to put the gas tank smack under the driver's feet in the Corvair.

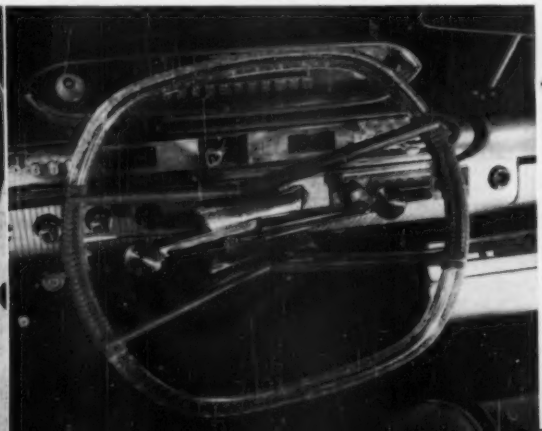
If Oscars were being awarded for 1960's safety-design performance in the standard brands, Chrysler would collect most. For in addition to the basic safety innovations that made their bow in the 1957 lines, this year's improvements, major and minor, include:

- Vacuum door locks that secure all doors automatically. These are actuated at the flick of a lever on the dash in front of the driver's seat.
- Adoption of unit construction throughout the line, except for Imperial. This is further enhanced by three to five roof bows for extra protection against rollover.
- Chair-height seats (with a higher backrest for the driver) as a preventive of fatigue from poor posture—induced by the low seating in virtually all other cars.
- Seat-belt brackets for the floor, with detachable belts that can be transferred to another car at trifling cost.
- Reinforced rear-window screening for station wagons that keeps children or pets in, and bugs out. This makes sense, considering the hot-weather vogue for riding with the transom open.
- The careful elimination of sharp edges, interior and exterior, throughout all seven lines.
- Standardization of transmission controls in every model built by the corporation.
- The elliptical steering wheel on Plymouth and Imperial, an extra-cost option but a godsend to short or fat drivers. In most other cars, even drivers with average physiques are uncomfortably pinned beneath overlarge circular wheels.

Nor let us forget the rear-window defroster; the full-width sun visors that plug that gaping center hole; the glareless electroluminescent instrument panel in Imperials

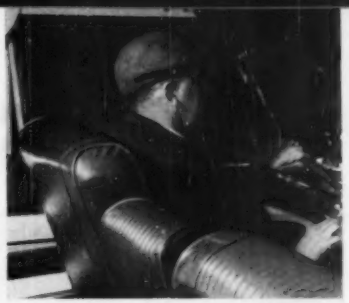
Door padding in Cadillac prevents contact with knee-fracturing door handles and other projections. These can be extremely hazardous in some older models.

Elliptical steering wheel on Plymouth and Imperial is an extra-cost option but worth the price in comfort and safety, particularly for short and plump drivers.



and Chryslers; and that "self-dimming" rear-view mirror, improved this year to show the outline of the car behind instead of just subdued lights.

To forestall any idea that we have gone on Chrysler's payroll, let it be added that that company's cars are not immune from criticism. Safety people are still dubious about the Auto-Pilot; cars are already so lullaby-smooth that the spread of throttle controls is disturbing. And something must be done about the knee-fracturing window cranks in models without power windows, the bad interior windshield reflections, and the chest-busting front seat back.



In Chrysler line, high backrest for driver and chair-height seats reduce fatigue—a problem in most cars where low seats invite bad posture.

Other cars rate high, too. Cadillac certainly has the right idea on seat backs, even if the sales literature is shy about mentioning it. Mercury, too, has a protective bolster along the top of the seat back.

Ford's continuing interest in safety features —so distasteful to the sales departments but so beneficial to the customers—is indicated by its current research in improved steering-wheel design, dash arrangement, seating, and a new crash-absorbent front end, which may or may not prove practical.

Mercury gets several other Oscars. One is for retaining last year's magnificent spaciousness in the cockpit, and for its excellent foot clearance for back-seat passengers. With a seat belt fastened around you in a Mercury, you couldn't jackknife into the well-padded dash unless you were Wilt the Stilt. No other car approaches this feature.

Padding where it gives the most protection to passengers in the back seat is Cadillac's bright idea for '60.

A second Mercury Oscar goes for its huge tandem windshield wipers, also carried over from last year but now upped to three speeds. In '60 these are augmented by a new spot defrosting system, in addition to the regular defrosters, for immediate visibility at the critical eye level. There is also an improved windshield washer. The combination puts Merc at the head of the class for foul-weather driving. [*Continued on page 245*]

Some Safety Oscars for 1960

Buick's rearrangement of door handles and window cranks to protect knees.

Cadillac's turn-indicator telltales on the front fenders.

General Motors' increasing abandonment of the horn ring, a potential stiletto.

Chrysler's four-light-flasher warning system to signal trouble ahead.

GM's reformation in reversing the jukebox trend in instrument panels.

Rambler American's simple instrument panel.

Pontiac's nonglare paint for instrument panel.

Some Design Demerits for the New Cars

Lack of leg clearance between seat and steering wheel in most cars.

Inexcusable location of window cranks and door handles in most makes, especially Plymouth, Chevrolet, Olds, Rambler.

Rambler American's shiny black dash.

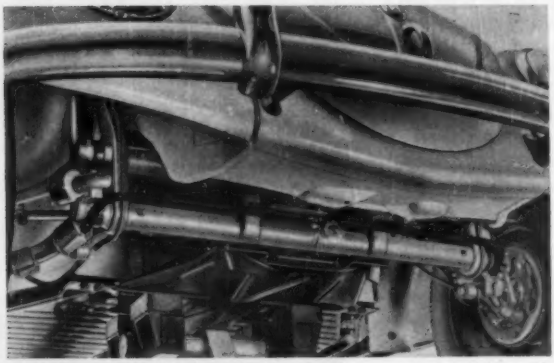
Prevalence of inadequate rear-view mirrors. Chrysler is an exception.

High-level spokes in many GM offerings, which nullify much of the value of deep-dish steering wheels.

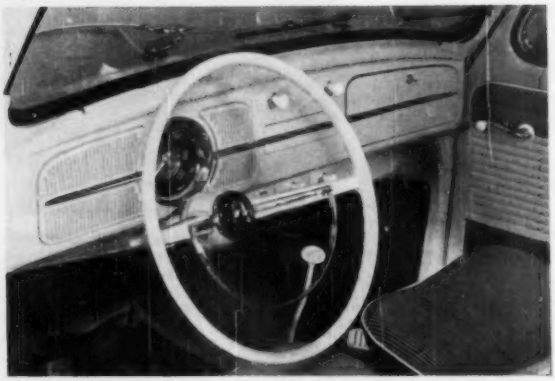
Arched molding on Corvair dash.

Protruding buttons along bottom of Falcon's instrument panel.

IMPORTS: Top Sellers Get Set to



STABILIZER BAR fitted to the front axle improves VW's road-holding by reducing body sway in fast cornering.



STEERING WHEEL is dished to absorb impact in a crash. Horn ring and slanted footrest for passenger are also new.

HEADLIGHTS on Karmann Ghia models ($1,000 extra) are set 1¾ in. higher. Air inlets and fly screen are larger.

Volkswagen

The 1960 VW still looks like a June bug. But, mostly inside and underneath, there are no less than 27 subtle changes in the little German two-door that leads foreign cars in U. S. sales.

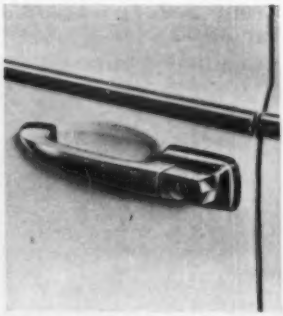
Some of the changes are shown here. Among others:

Fan belts are tougher, springs softer, defroster pipes bigger; generator output is up 20 watts to 180.

A padded sun visor replaces the sheet of smoky transparent plastic.

To reduce and shut out engine noise, the fan runs slower and there's more insulation in the floor plus a kickboard under the rear seat.

And soon, for about $70 extra, you will be able to get an automatic clutch—no left pedal—that disengages when you move the shift lever.



THUMB-BUTTON latches replace former pull-out door handles.

Meet U.S. Challenge

Renault A sports model now joins the popular Dauphine, which is unchanged. New Caravelle has hotter, 40-hp. version of Dauphine engine. Three-speed gearbox is standard, four speeds or an automatic clutch is optional.

SPORTY NEW CARAVELLE, a four-passenger luxury model, comes in coupe, soft- or hard-top convertible. Wheelbase is same as the Dauphine's, overall length is 13 in. more.

PLUSH INTERIORS match the Caravelle's six body colors. The separate front seats recline; rear seat folds down. A heater-defroster and windshield washer are standard.

English Ford New from stem to stern for 1960, the best-selling Anglia now looks rounded instead of boxy. A new front suspension uses independent coil springs with telescopic shock absorbers. Special asymmetric, semi-elliptical springs are used at the rear.

With a modest displacement of 997 cc. (about 61 cu. in.) the redesigned four-cylinder engine develops 41 hp. It has overhead valves, a high (8.9:1) compression ratio, and combustion chambers machined for greater performance. A top speed of 70 m.p.h. is claimed.

In the new four-speed synchromesh gearbox, only first gear is unsynchronized. A floor-mounted stick between the front seats does the shifting.

SHORT-STROKE ENGINE, only 7¼ in. high, permits a low hoodline that cuts wind drag. The hood flips open toward the front of the car.

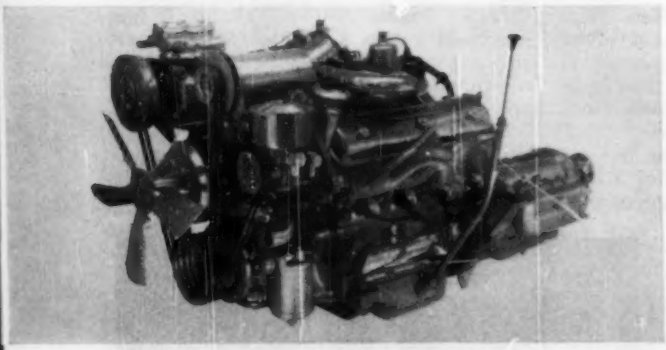
SLEEK NEW ANGLIA has a recessed, inward-sloping rear window, comes in 12 single colors and four two-tones. The body is unitized.

CONTINUED

Opel The Olympia Rekord sedan and caravan (station wagon) models sold here by Buick dealers show only minor changes for 1960. A small boost in compression ratio, from 7.5:1 to 7.8:1, adds one hp. to engine output—now 57 hp. It also raises top speed to 78 m.p.h. and gives the caravan more pulling power. The sedan now has larger tires: 5.90 by 13 instead of 5.60 by 13.

Simca New this year is Etoile (pronounced a-twal), an economy version of the best-selling Elysee model. It has the same styling and dimensions as the Elysee. The unitized, four-door body is powered by a 48-hp., four-cylinder, OHV engine of 78.7-cu.-in. displacement. There's a four-speed transmission, with a steering-column lever that allows three people to use the front seat.

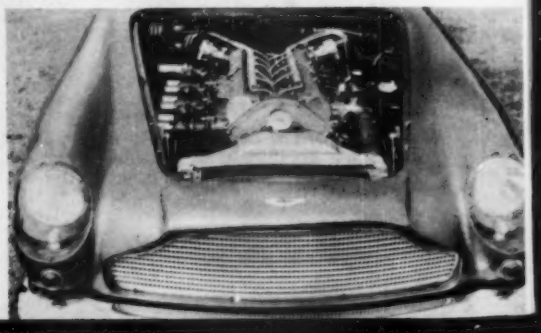
England's Car Makers Uncork Some Surprises



NEW ALUMINUM V-8 weighs no more than the six-cylinder engine it replaces on all Rolls-Royce and Bentley cars. Short-stroke, 380-cu.-in. power plant has twin carburetors, hydraulic tappets operating overhead valves, and aluminum cylinder block and heads. No horsepower is given, but the largest limousine is geared for 110 m.p.h. maximum. The four-speed transmission is automatic.

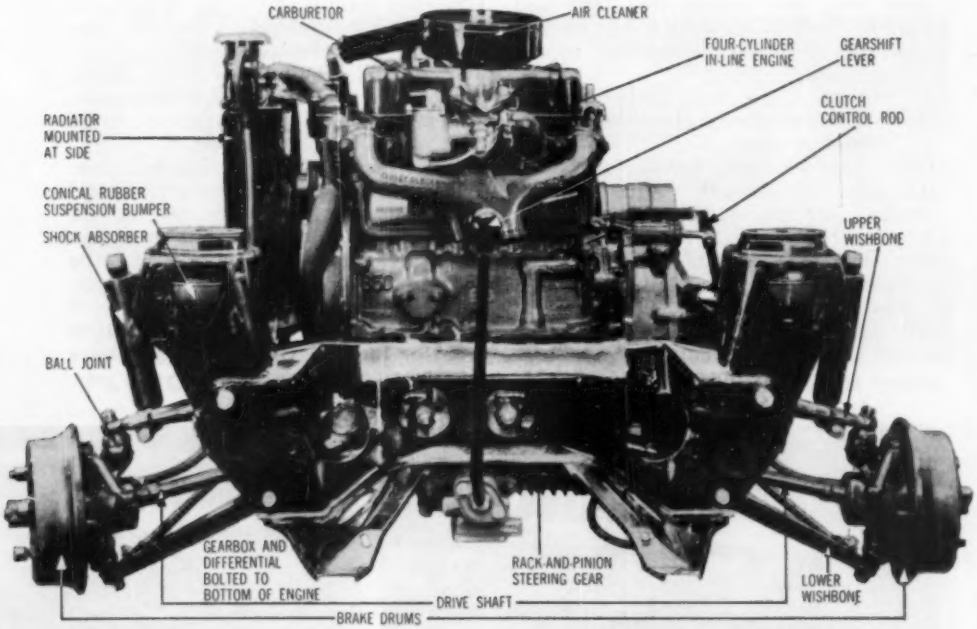
THREE-WHEEL BERKELEY weighs only 785 pounds, gets up to 60 m.p.h. in 14 seconds. Twin-cylinder motorcycle engine of 50 hp. drives the front wheels. The body is made of fiberglass.

TWO COMPLETE IGNITION SYSTEMS spark the Aston Martin DB4 G.T. two-seater. Its six-cylinder, twin-overhead-cam engine develops 331 hp. with three dual carbs. Top speed: 170 m.p.h.



Fiat A convertible two-seater with sports-car performance joins the popular (and unchanged) 600 model. The Cabriolet 1500's four-cylinder, double-overhead-camshaft engine develops 90 hp. and is capable of 105 m.p.h. Second through fourth speeds are synchronized. The front end has swinging arms, coil springs, and stabilizer bar. Rear has leaf springs and stabilizer bar.

Hillman New model of Minx sedan has restyled body, more power, an optional automatic transmission. Its windshield is 21 percent bigger, grille and rear body panels are new, front seat is lower. Engine output now stands at 56.5 hp. (last year's was 52.5). Four-speed box has closer gear ratios for snappier pickup. Optional no-shift transmission controls magnetic couplings electrically.



ENGINE SITS CROSSWISE in the Morris Mini-Minor to keep the car short and increase leg room. The 34-hp., four-cylinder engine drives the front wheels through a bolted-on gearbox and differential. All three units are lubricated by the same oil. Front suspension is by inverted rubber cones coupled to upper wishbones through tapered thrust bars.

VALIANT Newcomer to market, trig compact comes with four doors, two or three seats.

STATION WAGONS:

New Shapes and Sizes for '60

STATION-WAGON fanciers never had it so good. This year they've got more new shapes, sizes, and models to choose from than ever before. Even some with new nameplates: Dart and Valiant. And Ford's Falcon wagons will add still more variety when they appear in the spring.

Four car makers have added that favorite of den mothers and baseball teams, the three-seat wagon. The four are Buick, Olds, Rambler, and Rambler Ambassador. That leaves just three without three-seaters. Just one of these, the Mercury, is in the big-car class. The others, Rambler American and Studebaker Lark, are compacts.

The two Rambler three-seaters have a full-width rear door instead of the traditional tailgate. It's hinged at the left, swings completely open.

The trend away from two-door wagons continues. Ford offers just one; it had two in 1959. Mercury has dropped its two-door wagon. Plymouth has only one. Chevrolet completes the list of full-size-car makers still offering a two-door wagon. Even in the compact field, only Lark and Rambler build two-door wagons. Wagon buyers evidently feel the added convenience of two extra doors makes them worth their $35 apiece.

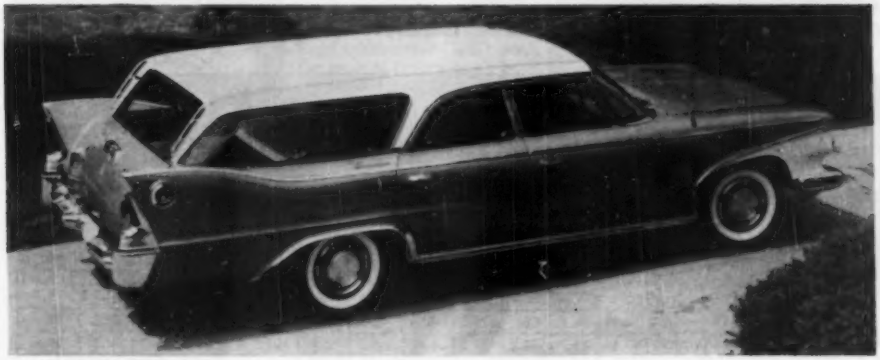
Wagons are no longer designed as afterthoughts. They get all the styling and engineering attention once reserved for standard cars. This was never truer than in the 1960 wagons. They're built to be quieter, handsomer, more comfortable, and to give a better ride. That's why, if total car sales hit predicted levels, 1960 could be the first year that wagon sales hit the one-million mark.

MERCURY The 1960 version is still tops in cargo space.

OLDS Third seat is optional

FORD Five inches longer, new model has five more cubic feet of cargo space than 1959.

CHEVROLET Styling has been freshened, but room inside remains the same.



PLYMOUTH All-new, it has unit body, a bit more cargo space. The fins look familiar.

for these restyled wagons.

DART New wagon offers economy six and V-8 engines.

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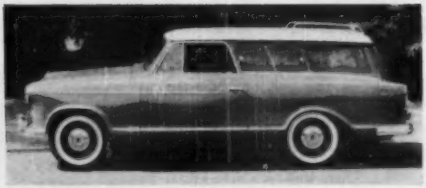
RAMBLER

LARK

PONTIAC



AMERICAN

CHRYSLER

BUICK

How the Wagons Compare

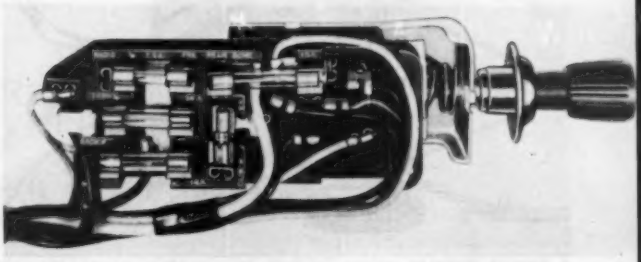
	Overall Dimensions			Hip Room		Cargo Space								
	Length	Width	Height	Front	Rear	Height of Rear Opening	Floor Width of Opening	Maximum Opening Above Tailgate	Width Between Wheelhouses	Length, Front Seat to End of Gate	Length, Front Seat to Closed Gate	Length, Second Seat to End of Gate	Loading Height of Tailgate	Cargo-Space Volume (cu. ft.)
BUICK	217.9	80	57.2	65.4	65.1	25.2	50.5	45.4	39.0	121.3	94.4	88.4	27.7	75.7
CHEVROLET	210.8	80.8	56.3	66.1	66	26.7	47.6	44.6	46.4	120.1	94.8	85.3	27.3	92
CHRYSLER	220	79.7	57.1	63	62.2	27.3	49.2	48.2	45.8	121.3	100.7	86	24.5	95.8
DART	214.8	78	55.4	63	62.4	27.3	49.2	48.2	45.8	121.3	100.7	86	23.8	95.8
DODGE	214.8	78	55.6	63	62.2	27.3	49.2	48.2	45.8	121.3	100.7	86	24.2	95.8
FORD	213.7	81.5	56.5	62.2	63.1	28.9	43	61.6	44.9	124.4	104.1	87.8	24.3	97.4
LARK	184.5	71.4	58.7	56.5	59	30.2	45	40	42	92	82.5	67	26.6	65
MERCURY	219.2	81.5	56.3	62.5	62.8	26.9	48.1	46.3	44.4	123.4	99.9	84.7	26.2	101.1
OLDSMOBILE	217.6	80.6	56.1	65.4	65.2	26.2	48.5	45.6	45.5	123.8	91.6	89	27.4	88
PLYMOUTH	214.9	78.6	55.4	62.6	61.6	27.3	49.2	48.2	45.8	121.3	100.7	86	23.8	95.8
PONTIAC	213.7	80.7	56.6	65.4	65.4	26.5	47.6	45	46.3	119.4	92.4	84.8	25.5	92
RAMBLER	189.5	72.2	57.5	59.8	60.1	24.5	50.8	47.8	43.1	104.5	82.4	70.6	26.7	80
RAMBLER AMBASSADOR	198.5	72.2	57.1	59.8	60.1	24.5	50.8	47.8	43.1	104.5	82.4	70.6	25.8	80
RAMBLER AMERICAN	178.3	73	58.1	58	45.2	26.4	39.4	38.5	40.6	84.5	68.5	53.9	25.4	52
VALIANT	184	70.4	54	57	57	27.4	41	52.6	42.6	106.3	82.6	61.2	24.3	72.3

Note: Wagons above are all 4-door, 6-passenger models, except for 2-door Rambler American; measurements are in inches unless otherwise specified.

ENGINEERING: New Ideas Will Cure Some Old Headaches

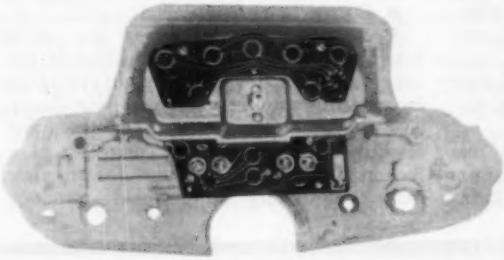
Hidden improvements should mean more miles without trouble and—hurray!—lower repair costs

By Hubert Luckett



FORD'S NEW HEADLIGHT SWITCH has a detachable fuse block behind it that can be snapped out for easy fuse replacement.

QUICK-DISCONNECT bulkhead connectors (left) on the new Mercury can't be plugged in wrong.



PRINTED CIRCUITS for panel connections on Mercury and Lincoln greatly reduce under-dash wiring clutter.

LINCOLN'S NEW POWER PANEL serves as fuse box and distribution center for all electric circuits. Connections are identified and wires color-coded.

Electrical systems are better planned

ELECTRICAL systems in most 1960 cars look, at last, as if they were planned instead of just happening. The improvised look, long a pet peeve of car owners and mechanics, is rapidly disappearing.

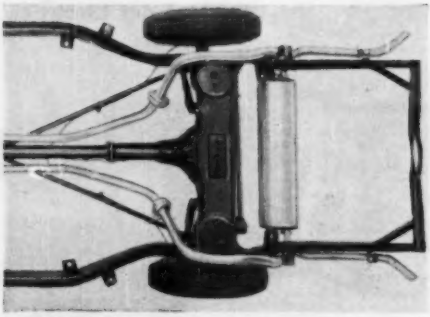
Here's what the new look in auto electrical systems will mean to you:

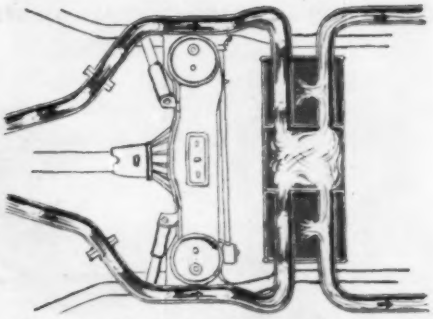
- Greater reliability; less chance of electrically caused fires.
- No more groping for hidden fuses if they blow.
- Better sealing of the firewall against engine fumes, noise, and heat.
- Speedier, and therefore cheaper, servicing of electrical troubles.

CONTINUED

Examples of the trend are the improvements this year on Mercury and Lincoln. Their completely redesigned wiring systems include:

- Printed circuits that replace wires in the instrument cluster.
- Keyed quick-disconnect connectors that can't be plugged in wrong. Bulkhead sockets on the firewall eliminate the need for holes through to the passenger compartment.
- Inclusion of the wires for several optional accessories in the standard wiring harness, eliminating the usual tangle of





A SINGLE MUFFLER serves for both single- and dual-exhaust systems on the new Buicks. Blending of the exhausts from the two cylinder banks is said to give more effective silencing.

Mufflers will last longer

EXHAUST systems on most 1960 cars are likely to give you less trouble than in previous years. Not because of any great engineering advances, but because manufacturers are spending more money on these troublesome parts, and showing more concern about their design and layout. (For other muffler news, see "Detroit Report," p. 62.)

Features formerly found only in the more expensive cars are now standard on most cars in the lower price brackets. Generally this means much wider use of:

- Laminated exhaust pipes.
- Asbestos-wrapped mufflers.
- Corrosion-resistant coatings.

Better noise-deadening is the main function of the first two, although the asbestos wrap does help prevent corrosion by speeding muffler warm-up. Aluminum-coated steel has proved to be the most effective way to combat corrosion at a reasonable price. All but a few models have completely aluminized mufflers.

Brake options are a tipoff to the future

THERE are two significant items of brake news in 1960. One is a little-noticed heavy-duty option offered by Pontiac; the other, the new optional brakes on the Corvette. Brake engineers are eyeing both developments with interest—not because a lot of them will be sold, but because they point the way to the most likely direction of future brake developments for production cars.

Pontiac is the first to offer the much-discussed integral aluminum wheel and finned brake drum. The new Corvette option uses sintered-iron brake linings and has a fan built inside the brake drum.

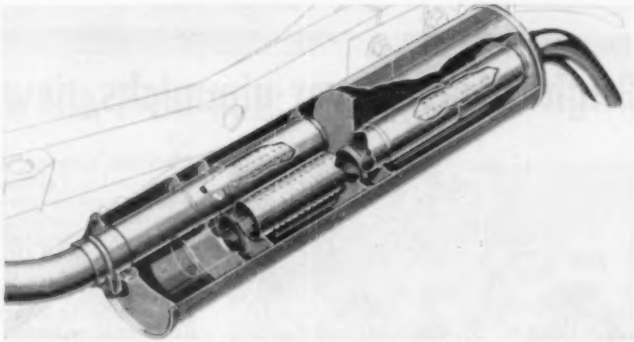
Most passenger-car brake specialists prefer drum brakes over disks for several reasons. Yet every manufacturer has had an active program for developing a satisfactory disk brake. The main reason for this has been the high-temperature brake-fade problem with current drum brakes

wires accompanying dealer-installed options.

• A central power panel on the Lincoln that serves as fuse box and distribution center for all electric circuits.

Some other makes, already using one or more of these features, have added further refinements this year. Ignition wiring has been changed. On most cars, the separate coil resistor is gone. The primary lead to the coil is a resistance wire that serves the same purpose. Resistance-core spark-plug wires are now standard on most cars.

DOUBLE-WALL exhaust pipes deaden noise better. More cars are using them this year.



CYLINDRICAL SHAPE OF FORD'S NEW MUFFLER—plus a new drainage system and complete aluminizing—gives it a longer life expectancy.

Some also have aluminized tailpipes. Other improvements on specific makes:

Ford has switched to a cylindrical-shaped muffler located far to the rear. The tailpipe, only a short stub, is part of the muffler itself. Engineers claim that the cylinder is inherently more resistant to corrosion problems than other shapes. New location gives cooler floorboards and eliminates the rust-prone tailpipe.

Mercury will not offer dual exhausts this year and is using separate resonators only on convertibles. The "cold" side of dual systems and the separate resonator cans corrode faster than a single muffler.

Chrysler-made cars have new flange-type, ball-joint connectors. Exhaust pipes are routed through the floor tunnel for better protection. Tailpipes as well as mufflers are fully aluminum-coated.

Buick has a unique single muffler for both single- and dual-exhaust systems. The muffler is mounted crosswise to the chassis behind the rear axle. The muffler used on dual systems has two inlets and two outlets; that on the single system has only one of each. The scheme eliminates the cold-side corrosion problem.

under abnormally heavy use. If this problem is licked, there would be little reason for taking on the separate and thorny problems of disk brakes on passenger cars.

There are two ways to beat the heat problem: Get rid of the heat faster or use brake linings that are effective at higher temperatures.

The Pontiac option disposes of heat faster because of the enormously increased radiating area of the integral wheel and drum, plus the higher heat conductivity of aluminum. The sintered-

CHRYSLER'S new three-platform brake design gives more positive brake-shoe guidance.

CONTINUED

iron linings in the Corvette option are effective at much higher temperatures than conventional organic linings. The strategically located fan increases the flow of cooling air where it will do the most good.

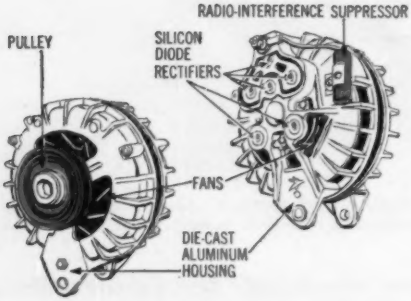
Here are other brake improvements on production cars by make:

• Buick. Vent openings have been added to the wheels and wheel covers for better cooling. New power brakes give smoother stops even with sudden, hard braking.

• Cadillac. Rear drums are finned and extended for better cooling. Brakes are self-adjusting.

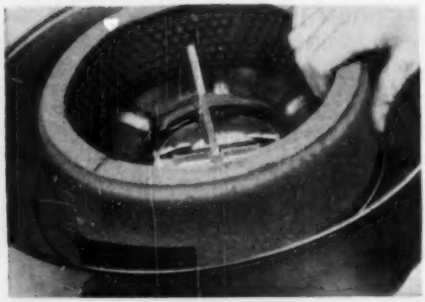
• Chrysler cars. New, three-platform design gives more accurate alignment of each shoe, assuring that the shoe meets the drum more uniformly over the total

Bright ideas, clever gimmicks, new conveniences



Chrysler's new alternator, standard equipment on the Valiant, marks a giant step forward in auto electrical systems. An alternator generates AC rather than DC. It is inherently a simpler, more durable, lighter machine than the conventional DC generator of similar capacity. Best of all, it has the happy ability to pump lots of juice (about 10 amps) even when the engine is idling. By reducing battery drain in slow traffic driving, it ends a major cause of early battery failure.

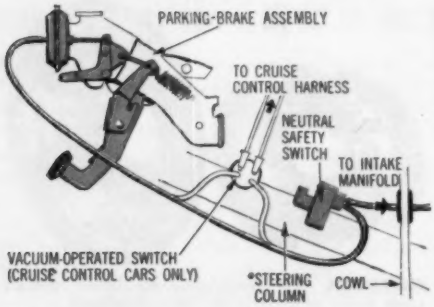
Tiny, highly efficient silicon rectifiers make possible this new power source for passenger cars. They convert the AC produced by the alternator to the DC required to charge the battery.



Polyurethane-foam air filters are used in several 1960 cars. Millions of winding oil-lined passages ambush dirt before it can reach the engine. The oil-wetted foam filter elements improve engine durability by doing a better job of trapping abrasives than wire mesh or pleated paper filters, according to engineers.

Other pluses: They're easier to service than conventional oil-bath air cleaners and they don't have to be replaced periodically as do impregnated-paper filter elements.

Cleaning the foam filters is simple: Remove the filter element and wash it in a cleaning fluid (gasoline will do), dip in clean lubricating oil, and reinstall.



Cadillac's emergency brake release won't let you drive your car away with the parking brake on. A vacuum-operated device "remembers" for you, and releases the brake automatically when the engine is started and the transmission lever is moved to any Drive position.

A diaphragm underneath the instrument panel is connected to the parking-brake mechanism. When the car is put in gear, a neutral safety switch opens and the diaphragm is actuated by engine manifold vacuum. A link from the diaphragm unloads the parking-brake pedal and a spring returns it to the released position. The new brake is foot-operated and also has a hand release.

contact area. Better guidance of the shoe is claimed to eliminate braking noise and allow closer adjustment to give more reserve pedal. The Imperial has redesigned wheel slots for better cooling.

• Chevrolet. Larger front-wheel cylinders increase braking effort on the front wheels to 58 percent of the total. Weather shields, added as a running change in '59, are continued.

• Ford. Drum widths on passenger cars are increased to 2½ inches on both front and rear, adding 25 percent in lining area. Front shoes on wagons are upped to three inches in width. New front drums are ribbed for better cooling.

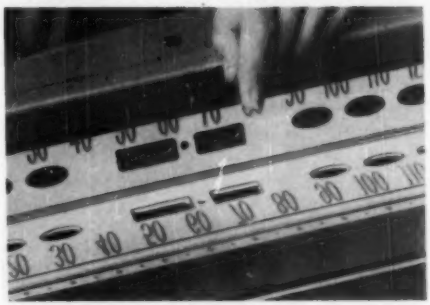
• Mercury, Lincoln. Brake-lining life is said to be increased 60 percent by thicker linings on secondary shoes. Self-

[*Continued on page 212*]

are plentiful in the 1960 cars

Buick's instrument panel has you reading dials in a mirror. The actual panel lies flat, facing the car roof. An adjustable mirror is mounted above it. Figures on the instruments are printed in reverse so that they read right when you see their reflection in the mirror. A knurled knob at each side of the panel lets you tilt the mirror to the best seeing position. There is no compromise in easy visibility for short or tall drivers.

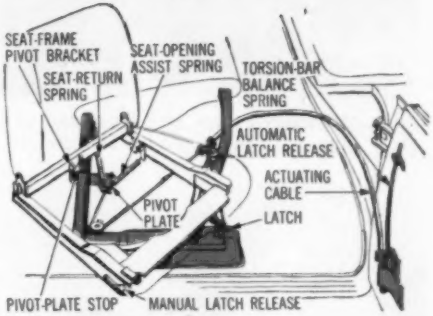
Doing it with mirrors also solves the problems of glare on the instrument faces and reflections of the instrument panel in the windshield. Gossip is that other manufacturers are coming out next year with their own versions of this idea.



Chrysler's automatic swivel seats take entry ease one step further than the swivel front seats pioneered by Chrysler last year. They're rigged to swing in and out automatically: out when the front door is opened, back to their normal position when the door is closed.

They work like this:

One end of an actuating cable is attached to the door, the other end to a pivot plate under the seat. A second cable releases the seat latch when the door is about half open. A spring helps swivel the seat out when the latch is released. When the door is closed, a heavier spring pulls the seat back until it latches in the straight-ahead position.



Thunderbird sun roof offers the fun of fresh-air motoring along with the convenience of a hardtop. A sliding roof panel—or "sun roof" as it's called in Europe—is an extra-cost option on the 1960 Thunderbird. The roofs have long been popular in Europe, but the Bird is the first production car in this country to offer the feature.

The all-steel panel slides, on aluminum guide rails, back out of sight above the head lining. Moving the panel all the way back makes an opening 19 by 34 inches. The panel can be locked anywhere in its travel. Fully closed, it latches firmly in place. Gaskets seal out drafts and rain. Channels and drain tubes take care of any seepage.

AIR SCOOTER: What It's Like

Let me at it, friend. I can drive anything on wheels. Where ARE the wheels?

All right, wind 'er up. But I can tell you right now, it'll never get off the ground.

The air sled, a vehicle without wheels, may be the car of the future. To give you an idea of how it feels to maneuver one of these strange craft, a PS motorcycle-and-scooter enthusiast climbed aboard an experimental model for a spin.

By Erik H. Arctander

I WAS tested by the air scooter, a ground-effect machine you steer by leaning. It started out the other way around, but she got the jump on me.

We first saw her sitting demurely on the hangar floor at Princeton University's Forrestal Research Center. "She's cute," enthused PS photographer Bill Morris, who has seen most of the species. Indeed she was. And more than a little mysterious.

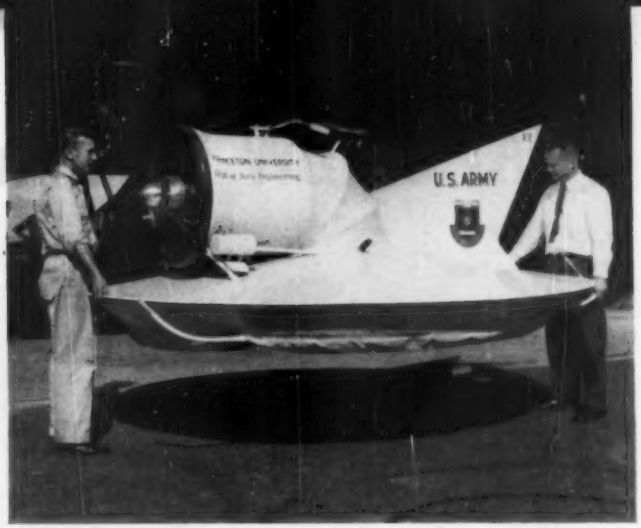
Tom Sweeney of the aero engineering department explained how the scooter works. "In the tunnel at the front is a propeller, driven by a five-horsepower gasoline engine. This sucks air in and forces it down against the ground through a narrow slot around the scooter's base. The machine floats on a circular cushion of air, a kind of air bearing."

Would Mr. Sweeney fly the thing so I could see how it was done? Sure thing. With long-legged ease he straddled the

According to Newton's third law, it is scientifically imposs—hey, I'm going UP!

Having wonderful time, wish you were here—instead of me. I miss my cycle.

to Drive



PS editor Arctander lifts the air sled (with a little help) just before his unnerving ride. "Guiding this beast is like steering wet Jell-O around a plate," he reported afterward.

bicycle seat and flipped a toggle switch. A helper yanked on the rewind starter handle, and an unholy roar filled the hangar. It was the raucous, unmuffled din of a chain saw. In fact, weeks earlier this engine had been part of a chain saw.

Sweeney turned the left twist grip. The roar got louder, its pitch higher. Abruptly the scooter rose on its tiptoes and sashayed lazily around the floor. Like an ungainly vacuum cleaner it droned a few yards one way, swiveled slowly around, and headed off in another direction. I watched Sweeney closely to see how he did it. He sat motionless. Yet I knew he must be shifting his weight enough to control the scooter's flight.

"You try it," Sweeney said, setting her down with casual precision. We carried the machine outside the hangar where there was more space. "Of course the wind may give you a little problem," Sweeney observed as I climbed aboard.

I opened the twist-grip throttle and the engine roared. I felt the tail rise—but the front edge stayed aground. I felt like a Sunday skipper who tries to go cruising without casting off.

"Sit farther back. Engine makes her nose-heavy," Sweeney yelled. I slid way back on the seat until my tail hung over the edge. I had to bend forward to hold onto the low handlebars. It was uncomfortable, but the scooter rose evenly. I was airborne, a few inches off the ground.

[*Continued on page 213*]

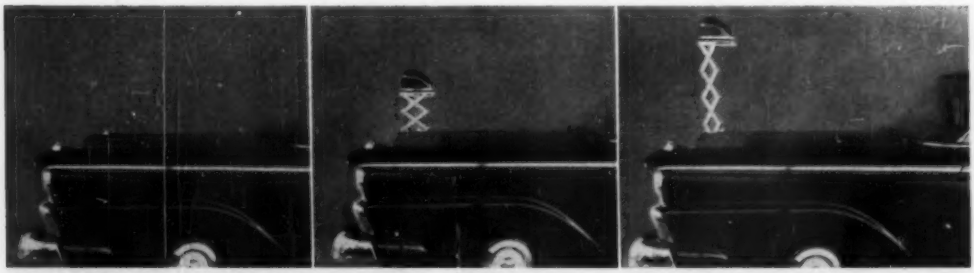
Aha, got the hang of it now. She's nose-heavy. Gotta lean back. OOPS—too much.

A perfect landing. It was kinda fun at that. Wonder if I set any altitude records.

WHAT'S NEW in Car Accessories

Family-Size Tent Fits Over Wagon's Gate

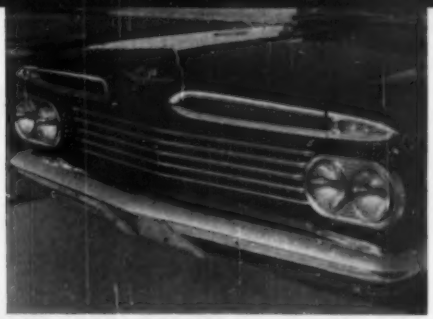
A tent that will sleep four adults goes on the tailgate of your station wagon to make the body part of the enclosure. It seals the car opening against weather, has a sun-shade canopy, a storm flap, two screened windows, and a sewn-in ground



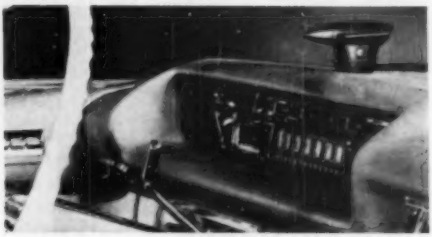
CONCEALED SIGNAL stays out of sight on prowling unmarked police car, rises to view when a violator is caught.

The red beacon is housed in the left front fender of the car and hidden by a hinged lid you'd never notice. It rises, lights up, and revolves at the press of a button on the dash. It's an undercover adaptation of the revolving beacon on the roof of some police cars. It serves, says the manufacturer, like the badge inside the coat of a plainclothes detective —ready for display when credentials are needed. For sale only to authorized agencies. Ghost Beacon Corp., 3801 NW 36th Ave., Miami.

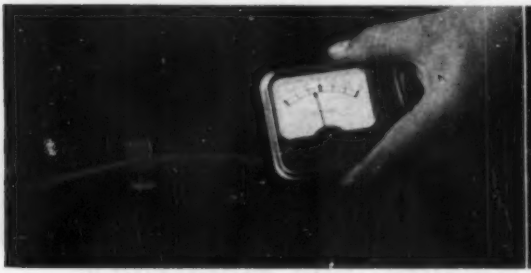
cloth that keeps out insects. The tent has no center pole; you can put it up in minutes. It is made of water-repellent, mildew-proof drill, weighs 30 pounds, and fits in a 38-inch carrying case. Cost, $129. Pop-Tent Corp., Clinton, Mich.



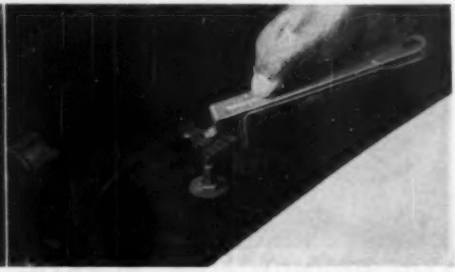
TUBULAR GRILLE of stainless steel will give your late-model Chevrolet or Ford a more massive, wide-front look. Mounting brackets and bolts are already assembled and ready to install. Price, $24.95 in stores; $29.50 shipped C.O.D. California Custom Accessories Mfg. Co., 1807 W. 65th St., Los Angeles.



BEAM CHANGER mounted on your dashboard automatically dims your lights even in overtaking another car. The electronic scanner picks up headlights 1,200 feet away, tail lights at 100 to 200 feet. It operates on a 12-volt car battery. Electronics Corp. of America, 1 Memorial Drive, Cambridge, Mass.



CURRENT INDICATOR when placed on the generator cable or any direct-current wire will give you a reading on the amperes passing through. No connection is needed. For generators and general use, zero to 75 amp., $2.69; starters, to 400 amp., $2.39. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.



TERMINAL LIFTER has a wrench at one end for loosening the hex nut, a lever at the other for prying the terminal off the battery post. You insert one prong under the clamp, hold the other on top of the post, and press up on alternate sides. 98 cents. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.

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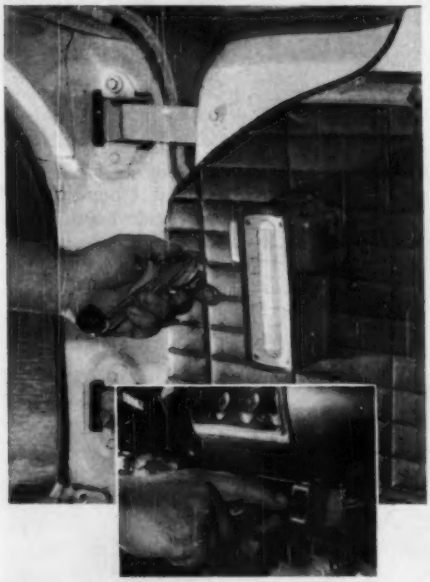
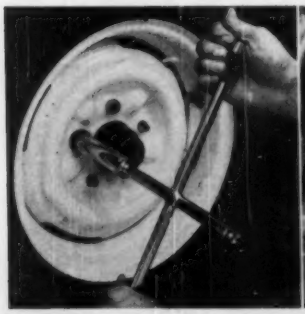
WHAT'S NEW in Car Accessories

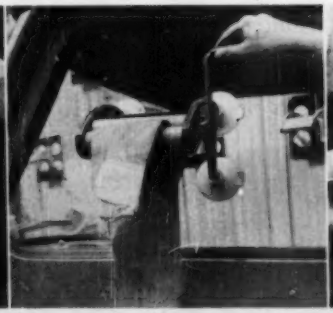


WINDOW MOTOR raises and lowers a window from a switch on the dash. It replaces the handle on the window crankshaft, works only on 12 volts. Each, $17.85; pair, $32.95. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.

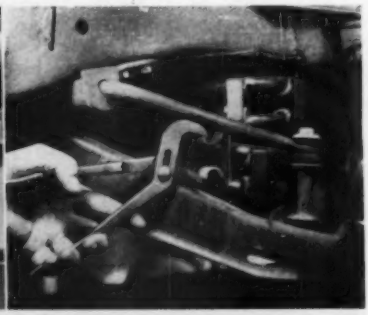
PICKUP COACH mounts on the bed of a light truck. It comes in three models, fits any make. Installation time, says the manufacturer, is 15 minutes. The aluminum-covered body is finished inside with birch, has a galley with a self-contained water system and icebox. It will sleep three. Coons Custom Coach Mfg. Co., Oswego, Kan.



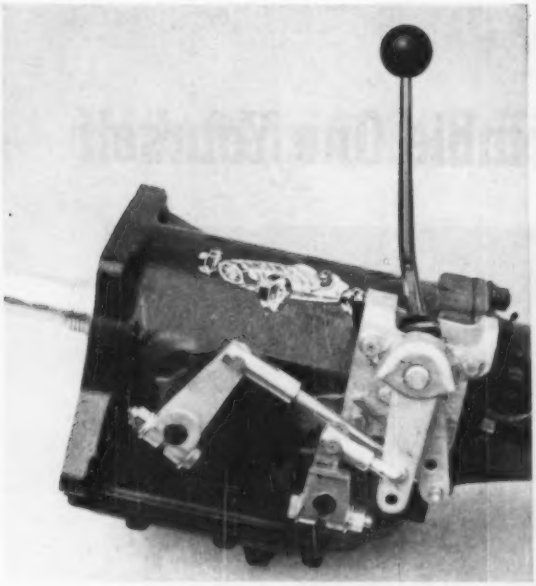
LUG WRENCH has one spring-loaded cross shaft. Its cup holds the lugs as you take them off to change a tire, automatically feeds them into position as they go back on. Price, $2.29. Sears, Roebuck & Co., 925 S. Homan Ave., Chicago.



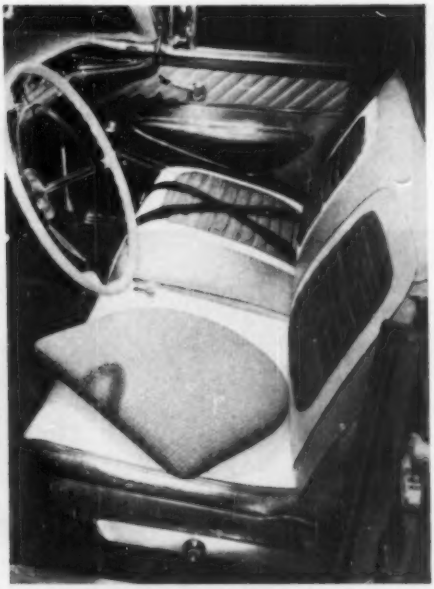
PLASTIC WRINGER attaches to the car window with suction cups so you can squeeze out the chamois as you wash. It can also be fixed to a trailer panel for camp laundering. Motor Rim & Wheel Service, 2860 E. Pico Blvd., Los Angeles.



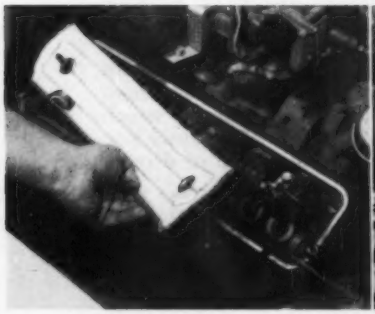
COIL BOOSTERS restore resiliency of springs. You press together the ends of the steel clips with pliers, slip them between the coils, and release. Package of 10 is $4.95. Perfection Automotive Products Corp., 925 W. Elizabeth, Detroit.



SHIFT CONVERSION fits on the transmission and gives you a stick on the floor. Kit contains side-shifting arms, linkage, and rubber boot to cap a two-inch hole cut in the floorboard for the spring-loaded stick. Racing model, $49.95 up. Without spring-loaded stick, $28.95. Ansen Automotive Engineering, 6317 S. Normandie Ave., Los Angeles.

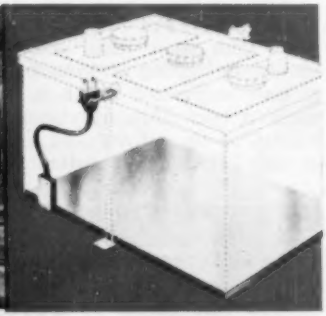


SWIVEL CUSHION is attached to a base plate that fits snugly over the driver's seat without raising its height materially. It swings to an angle of 60 degrees, lets you get out of a low-roof car with fewer acrobatics. The seat comes in five colors, can be switched from car to car. Milner Metal Forming Co., 3325 Regent Road, Cleveland.



VALVE SILENCER reduces tappet noise in overhead valves. A pad that's put under the valve cover after a soaking in oil, it also lubricates the valves. Price $1.69 up; for V-8s, $3.19 a pair. Earle Estes Mfg. Co., Union City, Ga.

TRUNK BELT holds a lid down when you overload or carry bulky pieces. Made of heavy-duty webbing, it has an adjustable buckle, a bumper plate, and a hook for one of the holes inside the lid. $1. Tennglad Corp., 200 Fifth Ave., NYC.



BATTERY WARMER maintains 60-degree temperature, assures fast starts in winter. You put the Thermo-Start electric plate under the battery and plug in an AC or DC outlet. $9.95. Visionator, Inc., 120 N. Peoria St., Chicago.

TACHOMETER:

You Can Assemble One Yourself

Completely self-contained, this compact unit mounts readily on the steering column or dash.

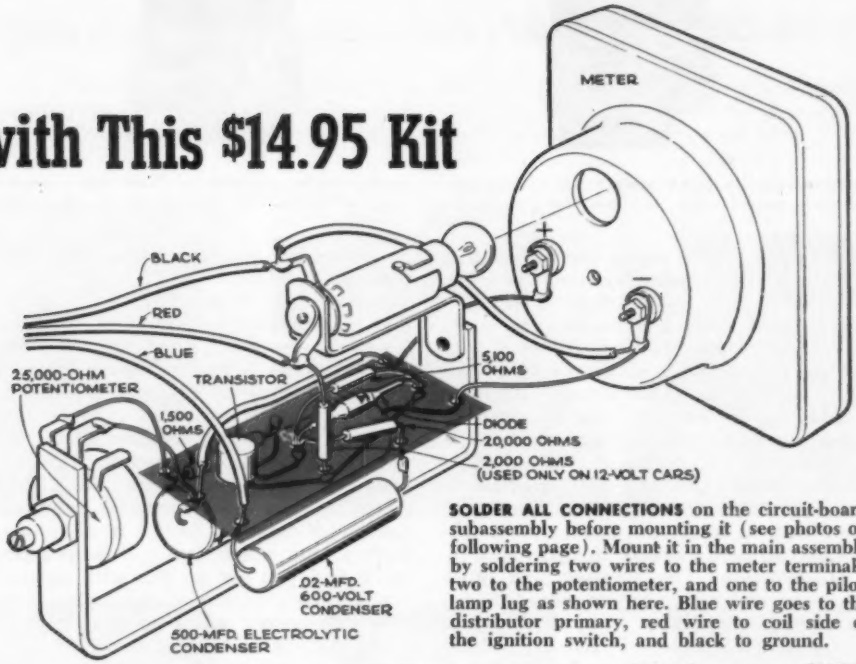
YOU can get more fun—and more practical use—from a tachometer than from almost any instrument you can add to your car. The hitch has always been cost.

Now the price barrier has been lowered considerably. For $14.95 and an hour or so of your spare time, you can build a handsome-looking rev counter with a dial already calibrated in r.p.m. and with a modern, back-illuminated face. If you are willing to do without the light, the tab is only $12.95. It's called the Pow-R-Tach. The complete kit to make this transistor tach is sold, mail order, by Almquist Engineering Company, Inc., Milford, Pa.

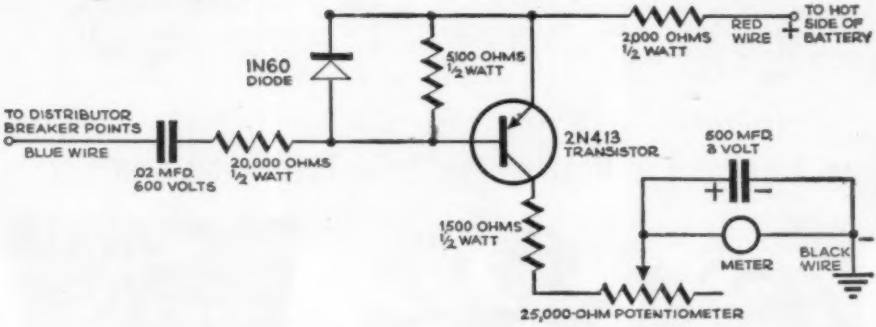
What's it good for? The speed at which the crankshaft in your car's engine rotates is *the* most important thing in determining its performance. There is a speed at which it achieves the maximum efficiency, another that gives maximum horsepower, and still another at which you get maximum torque. Obviously you can do a more intelligent job of driving

ONLY A FEW PARTS are needed to build this tachometer. Construction is simplified if you first make a subassembly of small parts. Condensers, resistors, diodes, and transistor are mounted on circuit board by threading leads through predrilled holes.

with This $14.95 Kit



SOLDER ALL CONNECTIONS on the circuit-board subassembly before mounting it (see photos on following page). Mount it in the main assembly by soldering two wires to the meter terminals, two to the potentiometer, and one to the pilot-lamp lug as shown here. Blue wire goes to the distributor primary, red wire to coil side of the ignition switch, and black to ground.



your car if you have an instrument that gives you a continuous report on how fast your engine is turning over.

You will also find the tach a valuable tool for tuning or trouble-shooting your engine. Most service manuals now specify r.p.m. at which various tuning operations should be performed. You can quickly spot a weak cylinder by observing the relative drop in r.p.m. as you short the plug on each cylinder in turn. The one that causes the smallest drop in revs when it is shorted is the offender. The tach makes the difference; the change in speed might be too slight to notice by just listening. You can also adjust your carburetor more accurately: Set the idle-mixture screw for maximum r.p.m. for a given idle-speed adjustment. You'll find dozens of other under-the-hood uses, too.

An advantage of this type of tachometer is that it doesn't need to be permanently installed. You can mount it for driving use, remove it quickly for convenient use in servicing.

How it works. Of the two types of tachometers, mechanical and electrical, the electrical is more popular, being cheaper and easier to install. The Pow-R-Tach is a transistorized electric type. It meas-

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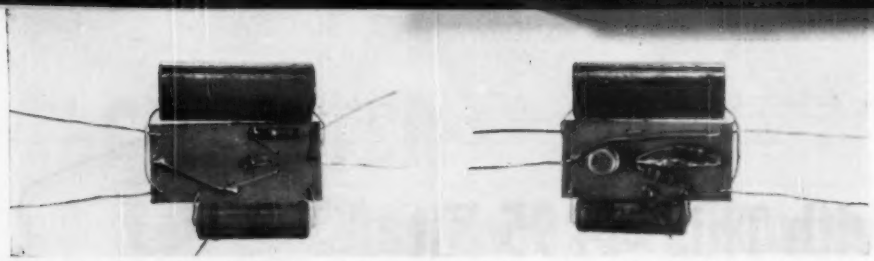


CIRCUIT-BOARD SUBASSEMBLY above has condensers pulled aside to show connections. Be careful not to overheat the diode and transistor when soldering. Too much heat can ruin them.

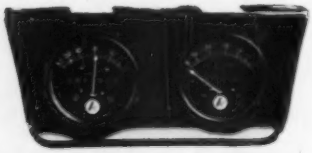
ures r.p.m. by counting the pulses that occur in an ignition system when the breaker points open. Since there is a pulse every time a cylinder fires, there is a direct relation between the number of pulses per minute and the r.p.m. of the engine. The transistor circuit integrates (adds up) the number of pulses occurring at a particular moment and reports the result as a DC voltage that is proportional to the pulse rate. A DC meter connected to the output indicates this voltage. But instead of showing volts, it is calibrated to read directly in r.p.m.

Installation. The simplest and often the most convenient way to mount the instrument is to clamp it to the steering column. A couple of gear-type hose clamps riveted together make a neat, effective mounting bracket. This can be easily removed for use under the hood. If you have room on the dash, a cutout template and mounting studs are supplied with the kit.

Calibration. You adjust the tachometer for accurate reading by turning the potentiometer shaft extending from the rear of the cover. The simplest way to get this initial adjustment right is to persuade a friendly mechanic to let you compare readings with his service instrument.

You can also do it yourself with a neon-light tester. With the engine idling, hold the tester on a spark plug and count the number of times it flashes in a minute. With a stop watch and a little practice you'll find you can do this with surprising accuracy. Since a particular plug fires once every other revolution in a four-cycle engine, you simply double the number of light flashes and set your tach to read accordingly. You need set it to read correctly at only one speed for all speed indications to be correct.

An Accessory to Replace the "Idiot Lights" on Your Car



EASY TO INSTALL on any car using a 12-volt electrical system, this kit includes all the wires, connectors, mounting hardware, and instructions that you will need.

THIS volt-ammeter kit makes a pair of instruments for a car having only a generator warning light. It tells you exactly how well your electrical system is working. An attractive addition to your instrument panel, it can be readily removed for trouble-shooting under the hood.

The voltmeter is a suppressed-zero type, spreading out the voltage readings in a range useful for indicating battery condition. The scale reads from nine to 15 volts. Instructions tell you how to gauge battery condition by the voltage readings you get under various conditions. The zero-center ammeter indicates charge or discharge up to 30 amperes.

The kit is available for $10.75 by mail order from Allied Radio, Chicago 80.

Know These Antique Autos?

Here's how these old-timers looked from the rear when a scorcher whizzed by with raucous honk of klaxon amid a swirl of dust. Maybe you can spot Ford and Chevy but how about Franklin or Overland? Front views and answers on next page.

1.....

2.....

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CONTINUED

Answers to Antique Auto Quiz on Preceding Page

. . . And here's how they looked from the front. These were popular makes in the good old days when motoring was an adventure. Good old days? Well, at least you could climb in and out without knocking your hat off.

1. 1912 Crawford

2. 1917 Franklin

3. 1931 Studebaker

4. 1917 Locomobile

5. 1912 Reo

6. 1913 Overland

7. 1910 Ford

8. 1918 Chevrolet

9. 1913 Hudson

SAM Sounds Off

SMALL BUT POWERFUL. The right section of the SAM assembly contains the air inlet; the left modulates air flow in process paralleling human voice production.

YOU are mowing the back lawn. Suddenly a thunderous voice blasts at you from the sky: "A tornado is moving in your direction. Take cover immediately."

You look up in amazement to see a parachute dropping lazily. As it gets lower, you make out a strange object hanging from the chute lines. Out of it comes the warning voice—the loudest you've ever heard.

Science fiction? Not at all. The voice is a loudspeaker named SAM—for Stanford Airstream Modulator, a development of Stanford Research Institute.

How it works. SAM differs from telephones and ordinary loudspeakers that produce sound by electrical impulses that vibrate a diaphragm. Rather, SAM is akin to the human voice—it modulates a stream of controlled air. Its voice box is a quick-acting valve that alters the flow of air according to the wave form to be produced.

SAM's potential is great. Most dramatic application so far has been parachuting SAM, a modification developed by Cook Research Laboratories. SAM-in-the-sky can be heard over a mile and a half away. It could be used as a propaganda weapon in wartime or to direct troops. It could alert citizens or guide rescue work in an emergency any time.

CHECKING: "How does SAM sound?" an engineer radios a researcher a mile away. In this photo, SAM has been hooked up to a siren.

SAM might also be a smog preventive. Attached to an afterburner in a car, the intense sound could speed up chemical reactions to break up exhaust hydrocarbons.

Or SAM could wind up in church—replacing the larger organ pipes. One SAM speaker with its 10-watt amplifier could handle all the low tones.—*M. L. Stein.*

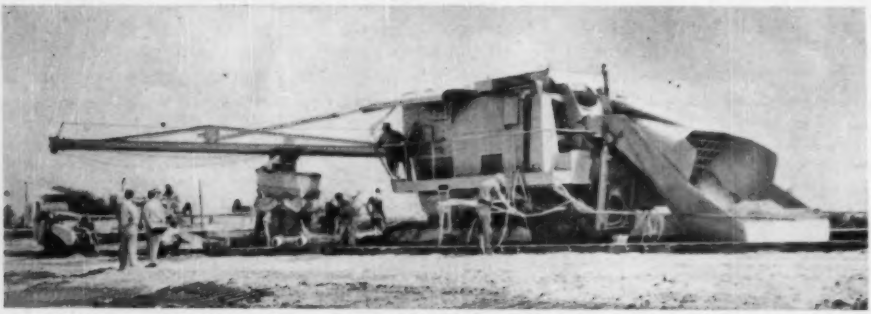
SAM'S LUNGPOWER can come from a solid rocket-fuel propellant. The burning gases have the same density as the surrounding air and eliminate the need for an air compressor. An aerial sound package weighs only 100 pounds—far lighter than conventional tape-amplifier-speaker system.

1. Three-by-16-foot log is hollowed with adzes.

2. The hull is trimmed and smoothed outside.

BOYS BUILD CANOE AS ANCESTORS DID

Using tools and methods resembling those of 1,000 years ago, a group of Northern Ireland schoolboys built a dugout



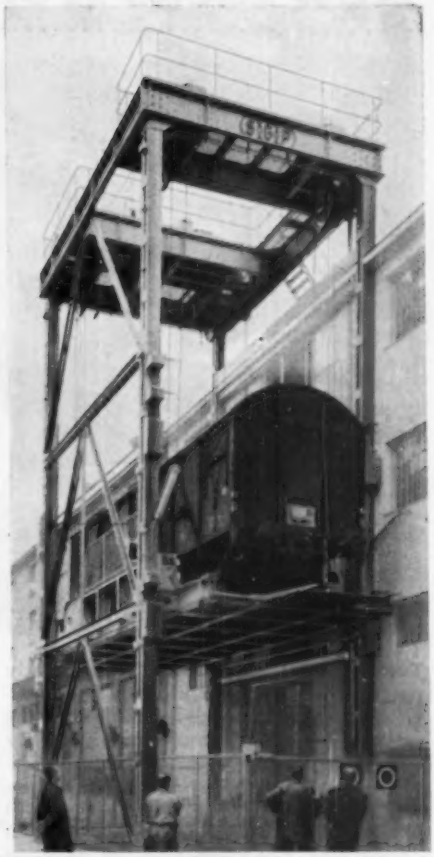
BIG PAVER FOR FAST JOB. A half-mile of highway, 24 feet wide and nine inches thick, can be laid in a single day by this paver, the world's largest. It pours 40 percent more concrete than the previous fastest. There's a three-compartment drum for mixing instead of the usual two, and electric controls make it simpler to operate. It's called the Tribatch by Koehring Co., Milwaukee.

DUAL TRUCK. A new experimental Army truck (left) has seats for five passengers. With the seats folded flat it can carry 1,500 pounds of cargo. The vehicle is similar to both the Jeep and the Mechanical Mule. It travels 60 m.p.h., has good suspension that makes riding easy on rough ground.

3. It paddles as easily as a store-bought canoe.

canoe from scratch. It took them three weeks. The project was part of a study of the island's ancient arts and crafts.

FOR DRY SIDEWALKS. Consideration for the poor pedestrian is being shown by New York City's Sanitation Department. Its new trucks spray water straight down instead of over the curb.



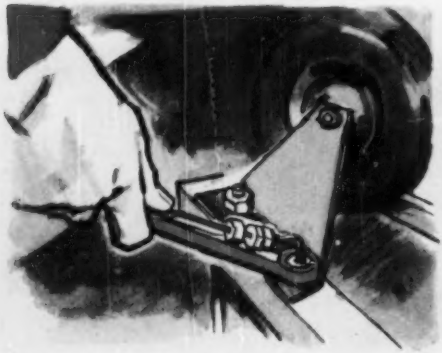
FLYING BOXCAR. The elevator above lifts 40-ton freight cars for loading and unloading on upper floors of a Vienna warehouse. Its electric hoist raises a section of track with the car.

FAST FREIGHT. A new Boeing 735 cargo liner at right, developed from the 707 jet, is being built to haul 100,000-pound payloads at 600 m.p.h. for three cents a ton mile. It will be powered by new turbofan jets, have a hinged tail to speed loading. The 735 goes into production next year.

New Ideas from the Inventors

Tunnel Tow Cuts Fumes. This recently patented conveyor would simplify tunnel-ventilating problems by eliminating the exhaust gases that often reduce visibility and make air unpleasant or dangerous. Trolleys rising from slots in the floor would pull cars through under electric—rather than individual-engine—power.

Wrench Stores and Feeds Nuts. With extra nuts racked on this flexible wrench-handle rod, you could just flip them, in turn, onto studs or bolts. Besides speeding assembly jobs, the quick feed would simplify repairs by storing nuts in their order of removal and replacement.



Cigarette Pack Clips Filters. You could offer guests their choice of plain or filtered cigarettes from this pack. When cigarettes were withdrawn from one end, a notched insert would engage crimped-on tips, so the filters would slide off. But they'd pass freely through the other end.

Claw Guard Protects Wood. To pull nails without marring a surface, you'd slip this rubber-cushioned plate over the head of your hammer. A metal loop at the claw end, and spring clips at the other, would permit quick attachment yet keep the guard from sliding under pressure.

Phone Index Times Calls. If needlessly long calls are boosting your phone bill, this combination timer and directory might save you money. You'd set its pointer when you made a call. The movement would show elapsed time and signal when the time set was up.

Mirror Looks Three Ways. Angled mirrors, says this inventor, would widen your rear view without distorting it the way a long, curved glass does, or confusing you with duplicate or overlapping images. Fixed to a frame, all three mirror sections would come into proper adjustment when any one of them was focused.

CONTINUED

More Inventors' Ideas

Tire Chains Fit Grooves. You could adjust these winter tires in a jiffy for any road condition. With the chains recessed in cross grooves, they'd travel quietly on clear pavements. Pried out (with a special tool) they'd overlie the tread, give needed traction on ice or snow.

Cover Knob Stirs the Stew. Twisting the knob of this pot lid would stir foods without uncovering them, thus keeping boiling liquids—or vigorously popping corn—from spattering or overflowing the pot. The knob would turn a socketed shaft on the underside of the lid. Bent-wire stirrers could be inserted when needed, easily slipped out for cleaning.

Saw Case Sets Up as Table. Folded into its case, this saw could travel to any job where electricity was available. Opened, the case would double as a saw table (with tilt and depth adjustments, miter-gauge grooves, and other features) and as a stand for grinding or sanding disks.

The following patents have been issued on these inventions: **Tunnel tow**—*No. 2,892,418 to F. Cena, Turin, Italy;* **Nut feeder**—*No. 2,772,592 to W. W. and J. W. Garber, Richmond, Va.;* **Cigarette pack**—*No. 2,782,788 to G. D. Sholty, NYC;* **Hammer guard**—*No. 2,879,030 to F. J. Loretitsch, Brooklyn;* **Phone timer**—*No. 2,780,016 to L. J. Laviana, Kensington, Conn.;* **Car mirror**—*No. 2,780,959 to L. Mannon, Palo Alto, Cal.;* **Tire chain**—*No. 2,561,910 to J. J. Coffey, Rutherford, N. J.;* **Pot stirrer**—*No. 2,778,613 to G. B. Long, Dayton, Ohio;* **Saw case**—*No. 2,786,500 to J. G. Unterfranz, Chicago.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

1. Original is put in place.

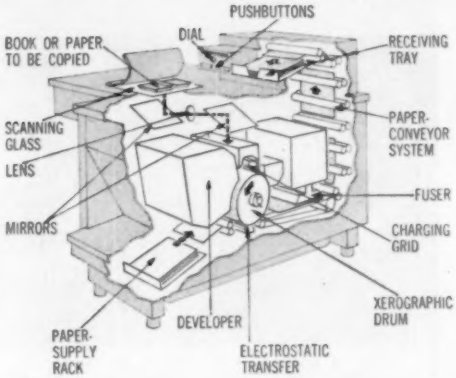
2. Number of copies dialed.

3. Finished work comes out.

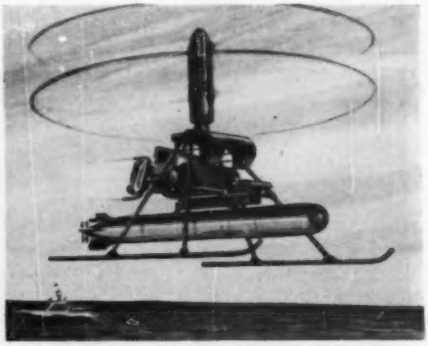
MACHINE COPIES ON ANY PAPER

Here's a copying machine that does not need treated paper to print on. It uses any good grade of ordinary paper; duplicates ink, crayon, or printed matter; is sensitive to any color.

Reproduction is by electrostatic printing—a fast, dry method of transferring an image by spraying a powder on a page charged with static electricity. Printing of copies is controlled by pushbuttons. The machine, made by Haloid Xerox, Inc., Rochester, N. Y., is distributed on a lease basis.

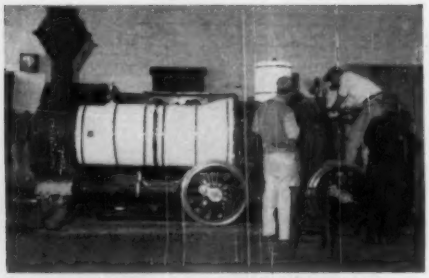


BRIDGE BEAUTY. The most beautiful steel bridge opened in 1958 was the 8,614-foot Mackinac Bridge in Michigan (PS, Oct. '56). It won't the competition conducted annually by the American Institute of Steel Construction.



COPTER DRONE. The helicopter in the drawing above flies by radio, and is controlled by the destroyer that launched it. It carries a homing torpedo for destruction of submarines. The Gyrodyne Co. is building it for the Navy.

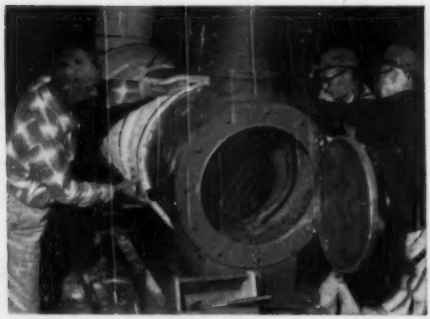
Rail Fans Build an 8-Ton



1 BRAINCHILD OF A TV TECHNICIAN, George Burton (at center), the Oregon begins to take shape in the Northern Pacific Terminal Company's roundhouse. Commercial artist Ron Wicke and pipe-fitter Roy Pomeroy stand by.

ANNOYED because a diesel-type streamliner hauled visitors over a sight-seeing railroad at the Portland, Ore., zoo, a group of local rail fans built a 32-foot-long live steamer for the line. Named the Oregon, she's a half-size reproduction of a famous western diamond stacker of the '70s, the Virginia and Truckee Railroad's Reno.

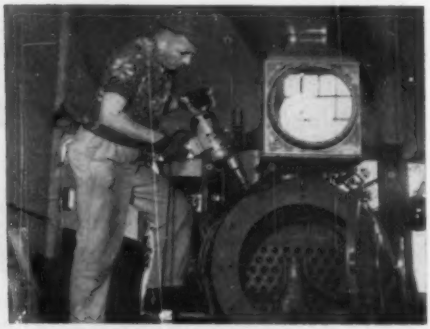
It took nine months for the amateur nut splitters to assemble the eight-wheeler from scratch. But they agree that it was worth the effort. Ignoring the streamliner, as many as 4,500 persons a day now swarm aboard the Oregon's five cars. What's more, her whistle can be



2 BOILER IS LAGGED with blocks of magnesia insulation. Adjusting the straps are retired lumberman W. H. Pancost, Burton, and oil-company representative A. A. Barnet.

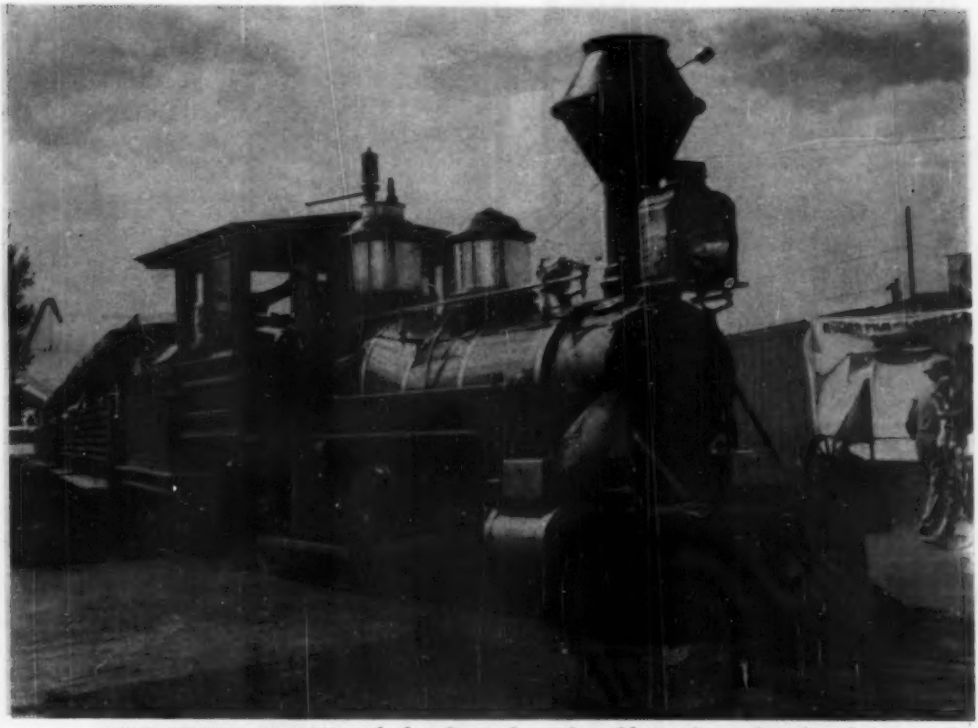
3 SETTING UP MAIN-ROD WEDGES was a job left to the skilled hands of E. S. Edwards, a retired Southern Pacific engineer. Patterns and castings were donated by local foundries.

4 OREGON'S FLAMBOYANT PILOT is bolted to the frame by Wicke and Burton. Made of eastern oak and painted a bright vermilion, it's the handiwork of a Pacific Telephone Co. plant staff assistant, Chet Wheeler.



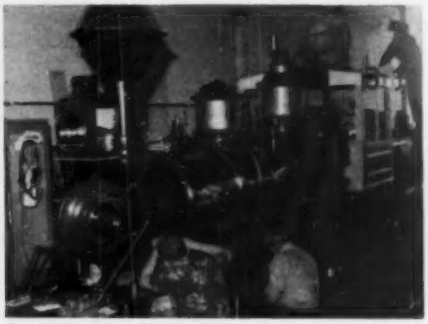
5 USING A DRILL, Wheeler bores holes for the hand-rail brackets. Open smokebox door shows the arrangement of the fire tubes and exhaust nozzle from the cylinders. The boiler has an operating pressure of 175 pounds.

Locomotive



HOBBYIST-BUILT OREGON made her first public appearance at the Oregon Centennial Exposition, displaying white flags that mean, to railroad men, a special run. Half-size copy of an old-time diamond stacker, she's now operating on the Portland Zoo Railway, a nonprofit narrow-gauge system winding among the scenic West Hills over some two miles of track.

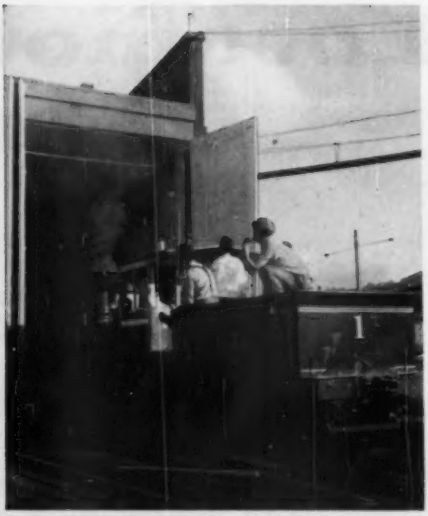
6 **HAND BRAKE IS RIGGED** on the tender by John Labbe, an ex-logger and author of railroad books. Unlike her prototype, the 1872 Reno, the Oregon has modern air-brake equipment presented by the local street-car company.



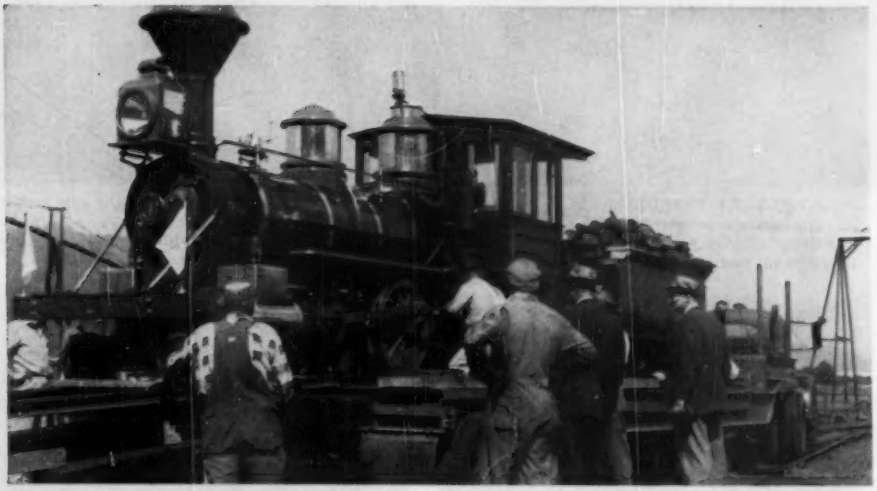
7 **NEARING COMPLETION,** the Oregon is resplendent in black and red livery, with touches of green trim and plenty of brasswork. Scenes of Crater Lake and Mount Hood, on the sides of her headlight, were painted by artist Ron Wicke.

CONTINUED

8 WITH STEAM AT THE POP-OFF POINT, former throttle-jerker Edwards adjusts the whistle. Scrounged from a retired logging engine and silent for 20 years, this steam whistle can burst into an exuberant "w-a-a-h—h-o-o-o!"



9 MOMENT OF TRIUMPH: With George Burton at the latch, the Oregon backs out of the roundhouse under her own steam for the first time. A third rail has been laid to accommodate the narrow-gauger on standard track.



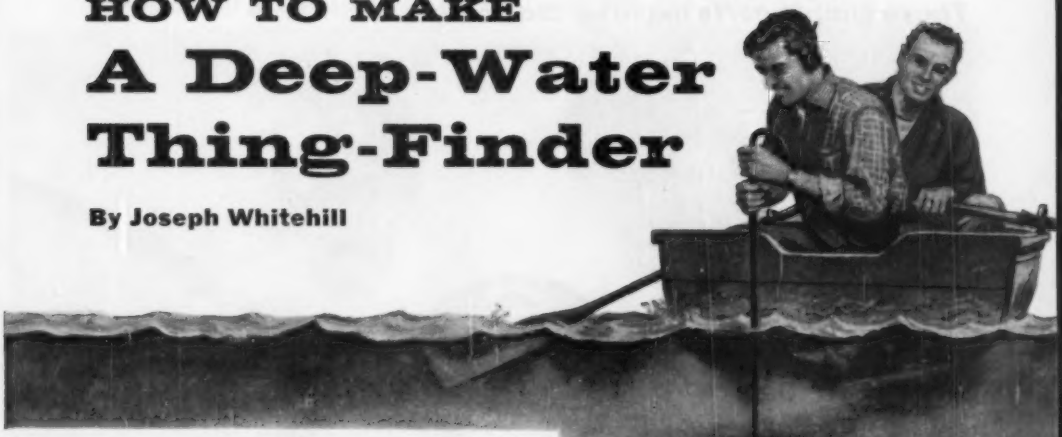
10 OFF TO THE EXPOSITION on a flatbed trailer. Oregon cost $19,000 to build, is valued at $50,000. The cordwood in her tender is only for effect—under it is a 150-gallon tank for the diesel oil she burns as fuel. She uses about 15 gallons an hour, hauling five cars.

heard over a wide area of Portland—a raucous reminder that steam railroading is very much alive.

The Portland zoo trains aren't toys. Both streamliner and steamer carry adults as well as children, operating in conformity with railroad traffic rules, regulations, and traditions. The Oregon weighs about eight tons. She's five feet wide and nine feet to the top of her diamond stack, and she gleams in vermilion, green, and polished brass.—*Ellis Lucia.*

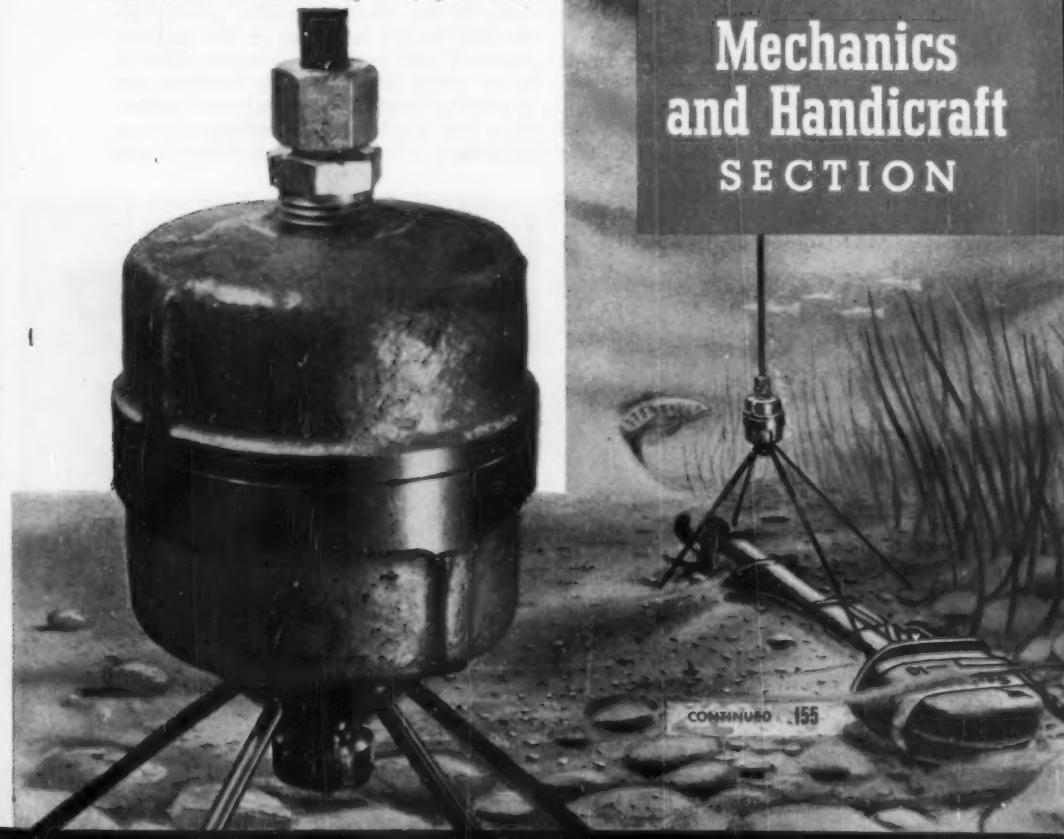
HOW TO MAKE
A Deep-Water Thing-Finder

By Joseph Whitehill



EVERY summer people lose thousands of dollars' worth of equipment overboard—fishing gear, portable iceboxes, outboard motors. All could be raised and reconditioned if found promptly.

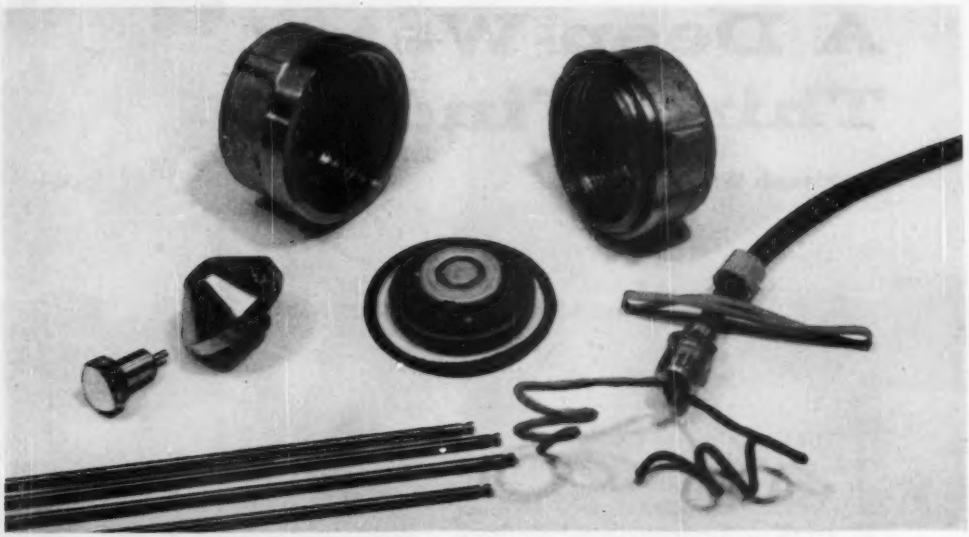
Using this underwater finder with its antenna-actuated microphone, you can



Mechanics and Handicraft SECTION

CONTINUED

These simple parts make up the finder



FINDER PARTS ready for assembly. Any carbon-button mike (center) can be used as long as its dimensions are close to Western Electric's type T-1, which is 1 13/16" in diameter.

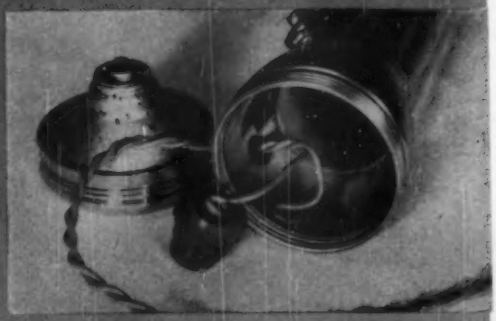
locate sunken equipment without getting your feet wet. It once probed an acre of bottom in three hours to locate a small cruiser sunk in 78 feet of water.

The finder makes use of the fact that a slender metal rod fixed rigidly at one end will vibrate if touched at the other. The tone of the vibration varies greatly according to the hardness of the material touched, just as a bell produces different tones when struck with a hammer and a piece of wood. Four metal rods (antennas) are mounted on a waterproof case housing a microphone that receives and

LIST OF MATERIALS

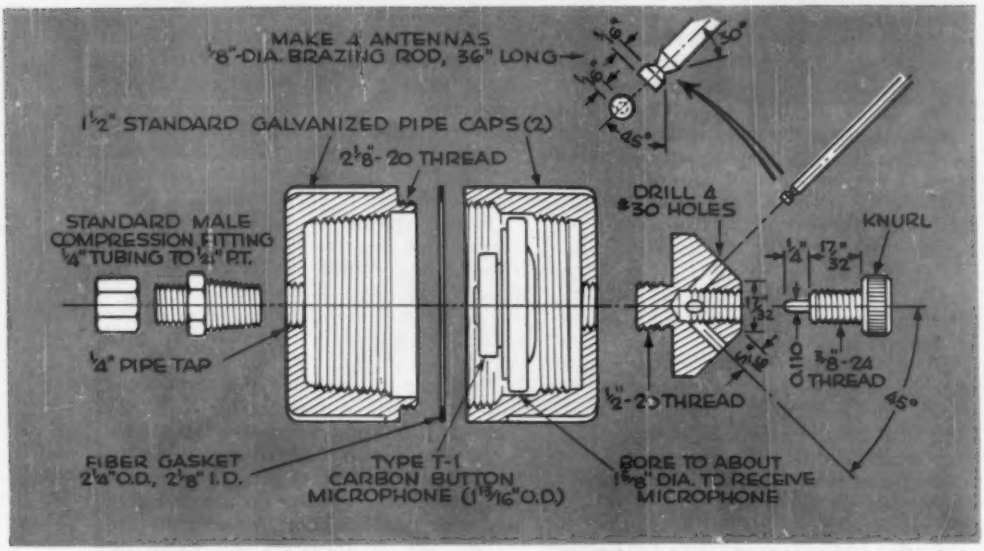
2	1½" galvanized or brass pipe caps
1	Male compression fitting, ¼" tubing to ¼" pipe, for the wire gland
1 pc.	Cold-rolled steel or brass rod, 1½" dia. and 1½" long for cone
1 pc.	Brass rod, ⅝" dia. for lock screw
4 pcs.	Brazing rod, ⅛" dia. by 36" long for antennas
1	Type T-1 Western Electric carbon-button microphone
75 ft.	Rubber-covered wire, ¼" O.D.
1	Low-impedance headphone set
1 tube	Gasket compound (Permatex)

Wiring the parts together



THREE VOLTS OF CURRENT operate the finder. A flashlight adapted as shown makes a convenient power pack, or you can use a pair of No. 6 dry cells taped together and wired in series.

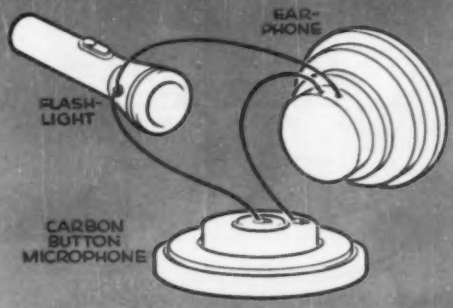
Pipe cap provides a solid housing for the microphone



SOME INTERESTING LATHE WORK is needed to convert two iron or brass pipe caps into a waterproof housing for the microphone. All of the finder's threads are sealed with gasket compound.

transmits vibrations to a listener in a boat above. With a little practice, the listener can distinguish, from the different tones, a mud bottom from one of sand, or a metal object from a sunken log.

Most of the parts used to make the machined finder shown in the photos can be bought at a plumbing-supply house. If you lack access to a lathe, you can build a workable finder inside a typewriter-ribbon can and waterproof it with hot roofing asphalt. Both use a type T-1 Western Electric carbon-button microphone and low-impedance headphones



WIRING is a simple series loop connecting batteries to earphones through the microphone. Antenna vibrations cause the mike to vary current, producing different tones in the earphones.

MICROPHONE above is installed in bored-out pipe cap. Wires are soldered to center button and metal ring around it. Pre-tin wires and use hot iron briefly to avoid damage to mike.

CONTINUED

available over the counter or by mail from any radio-parts house.

The lathe-made finder. This is a rugged instrument made from two 1½″ pipe caps. Make the top half of the case first, from one of the pipe caps. Chuck it in the lathe with the open end out. Face and turn the rim to clean up the roughness of the casting, and bore off the pipe threads for a short way inside the cap. Shoulder the rim of the cap to 2⅛″ diameter and turn a 3/16″ length of 2⅛″-20 threads on the shoulder. Reverse the cap in the chuck, face the end, and drill and tap for the ¼″ pipe thread of a male compression fitting.

Face and true the rim of the second cap as you did the first, then bore the inside diameter to 2 1/16″. Cut a ¼″ length of 20-pitch threads in this diameter, testing until the upper half of the case screws easily into the threads. Bore the inside of the second cap to receive the microphone.

Fitting the antennas. Turn the bottom half of the case around in the chuck, face the end, then drill and tap a ½″-20 hole in the center to receive the antenna cone.

Turn the antenna cone from 1½″ rod. First turn the ½″ diameter that will later be threaded, making it extra long—about ¾″—to provide something for the chuck to grip while turning the conical face. After turning the cone, decide whether you want to put in the extra work to make the locking screw that holds all four antennas in place. If you do not, drill and tap four No. 6-32 holes in the cone. Thread an end of each antenna to fit.

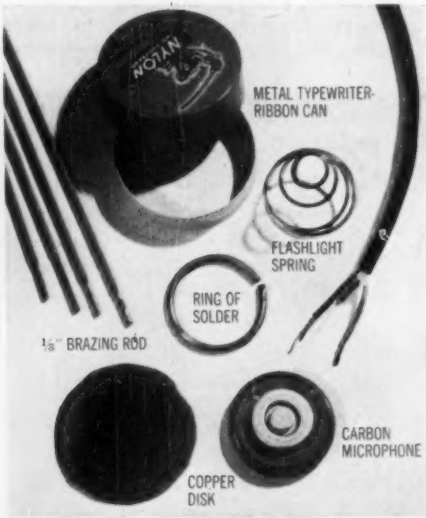
If you decide to make the locking screw, drill and tap the flat end of the cone ⅜″-24 about 11/16″ deep. Drill four No. 30 holes in the cone to receive the antennas. Reverse the cone in the chuck, trim the ¾″ stud to ⅜″ and thread it ½″-20.

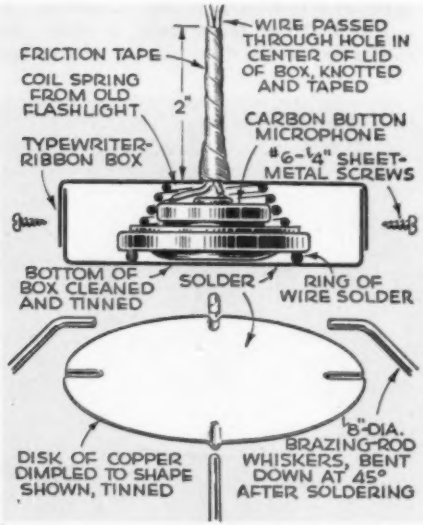
Turn the antenna locking screw from ⅝″ rod, knurl it and thread it ⅜″-24. Turn a .110″ shoulder on the end of the screw and put a 45-degree chamfer on the end of the thread. Tin the chamfer with soft solder to take up any inequalities when you tighten in the antennas.

Two sets of antennas will make the finder sensitive to both large and small objects. Make one set 36″ long for general searching, the other 18″ long for

[*Continued on page 228*]

A tin-can way to make the finder



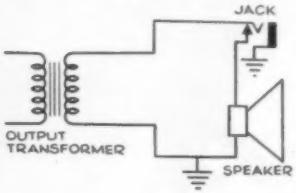


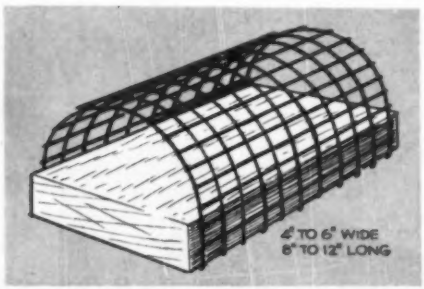
TYPEWRITER-RIBBON CAN houses the microphone in this version, which can be made in short order. A ring formed of solder holds the mike away from the bottom of the can. A spring from a flashlight presses it firmly in place. Waterproof the completed job by coating the can and the last 6″ of wire leading into it with a ⅛″ layer of hot roofing asphalt.

Short Cuts and Tips
FROM PS READERS

Private Listening for Rock-'n-Rollers

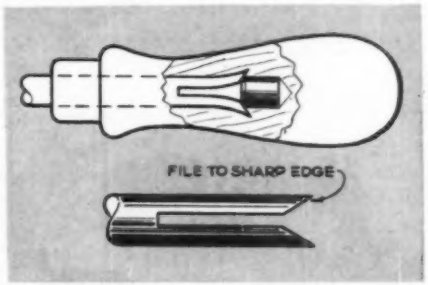
ADDING this head-phone jack to your car radio permits individual listening—one person can hear the radio without disturbing other passengers. When the headset is plugged in, the speaker automatically shuts off. The jack also can be used to connect a second speaker for use outside the car. Only one part—a closed-circuit jack—is needed. Mount it anywhere it's convenient. The diagram shows the circuit changes.—*Hartwell M. Hughes, Inglewood, Cal.*





Scraper for Shovels and Spades

HARDWARE cloth, nailed in a semicircle over a wooden block, makes a good scraper for removing moist dirt from the curved surfaces of garden tools. The cleaner can be nailed to a post or fence in the garden. Doubling the mesh adds rigidity.—*R. Loewen, Baytown, Tex.*

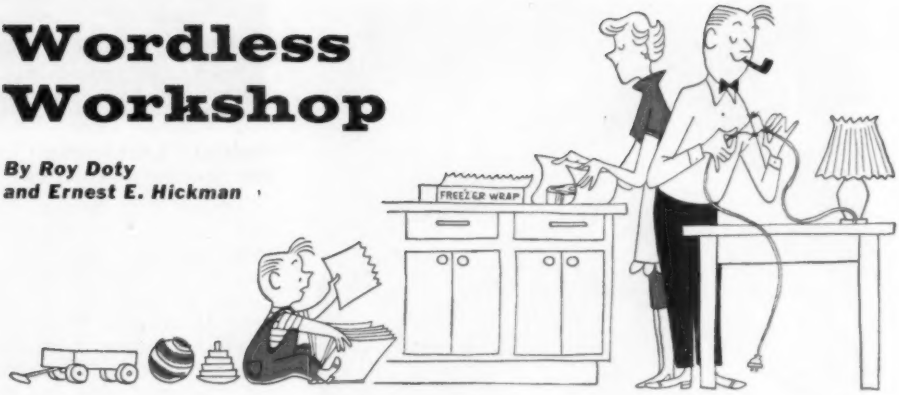


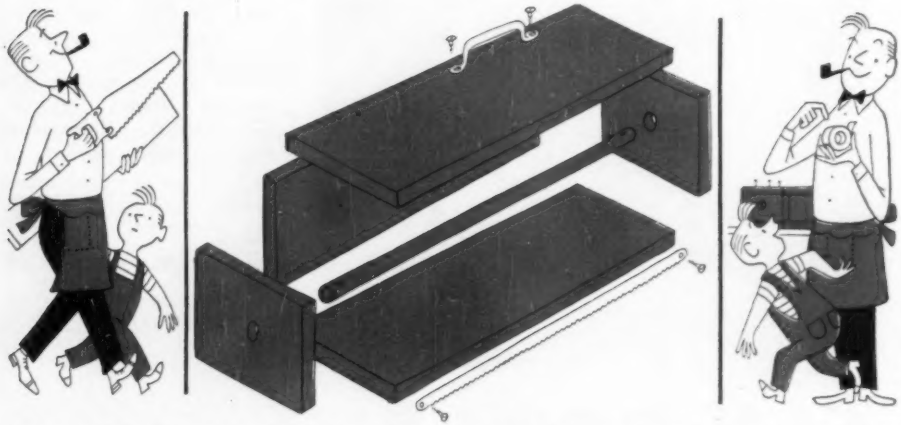
Securing Tools in Handles

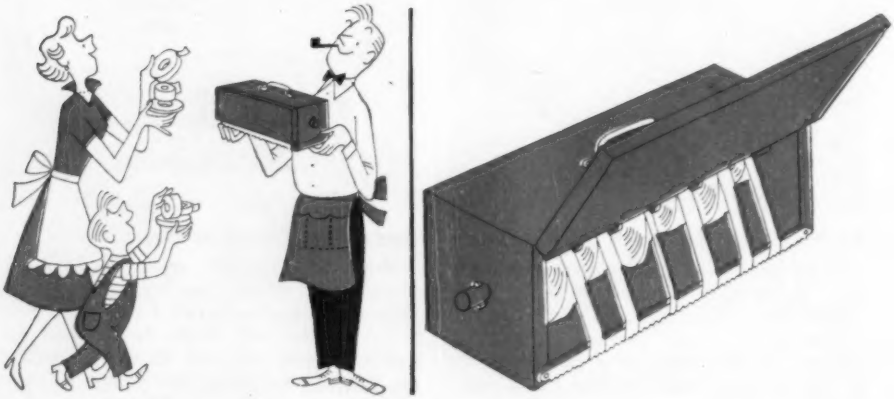
SCREWDRIVERS and other tools made from round stock can be securely anchored in wooden handles this way. Saw a slot in the end of the tool; when the tool is driven into the handle against a chamfered steel plug, the prongs expand and dig in.—*F. Murray, Chicago.*

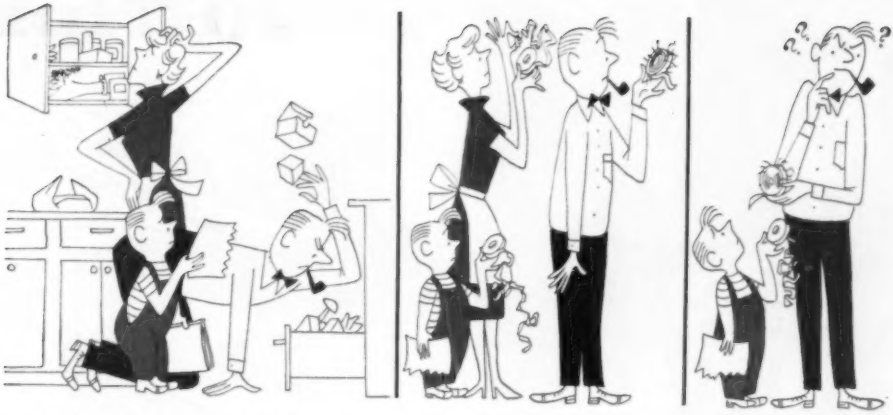
Wordless Workshop

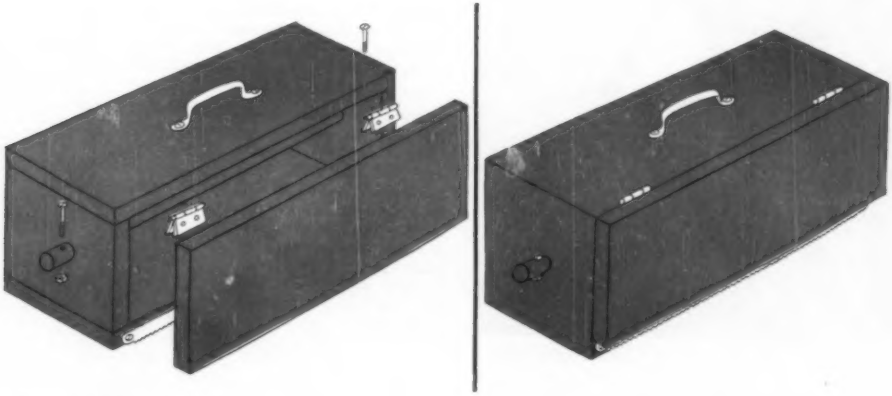
By Roy Doty
and Ernest E. Hickman







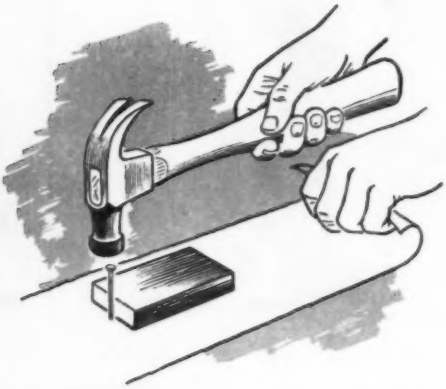




DOTY

10 Tips

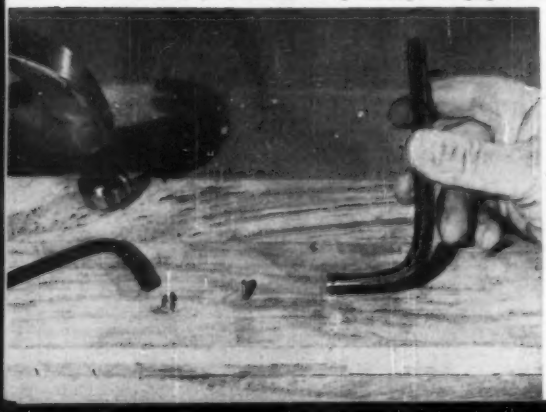
WEIGHTED LINE, suspended from a nail driven at the top of a wall and into the center of a stud, serves as a guide for nail centering all the way down. If nails must be accurately spaced on the wallboard, mark the desired intervals on the cord with fingernail polish or quick-drying paint. It will prevent carelessly driven nails that poke through walls and show up inside.



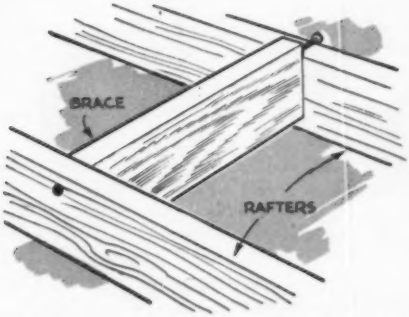
WHEN YOU MUST USE ONE HAND to flatten or stretch material taut while starting a nail, use a small bar magnet to hold the nail upright until the shank is securely anchored.

BORE A ¾" HOLE about 2" deep in the end of your hammer handle and fill it with cup grease or soap. When hammering nails in very hard wood, stick their shanks in the hole to pick up a bit of the lubricant and you'll find that they drive a great deal easier.

BEDDING THE POINTS of clinched nails safely in the wood is easy with this tool that you can make in minutes. Hacksaw a groove in a piece of drill rod, wide and deep enough to grip a 12-penny nail. Then give the rod a right-angle bend to form a handle. Lever nails over, staple-fashion, and complete the clinching job with a couple of sharp hammer blows.

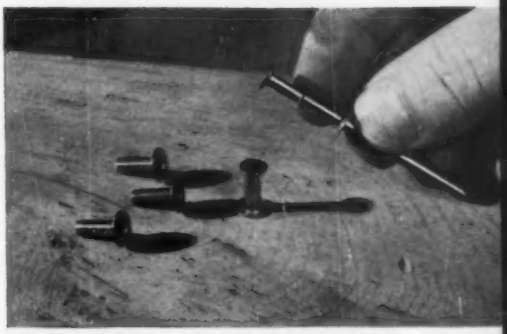


for Better Nailing

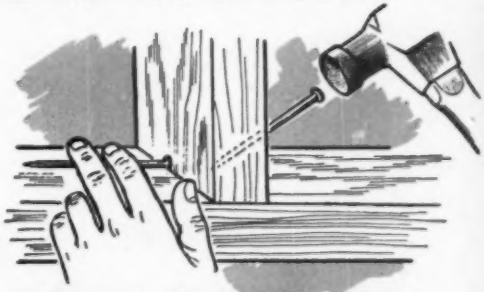


WHEN NAILING BRACES between rafters it's often impossible to hold them in place while driving the first spike. Try this simple dodge: Start a nail into the far end about ¾" down from the top and hook it over the adjacent rafter. Drive a single nail into the other end. Then pull out the starter nail, tap the brace into final position, and finish the job.

IF YOU'RE BORING HOLES for nails in hardwood, clip the head off one and use the nail as a drill. The holes it makes will be just the right size. You'll find, too, that nails don't break as easily as small twist drills.



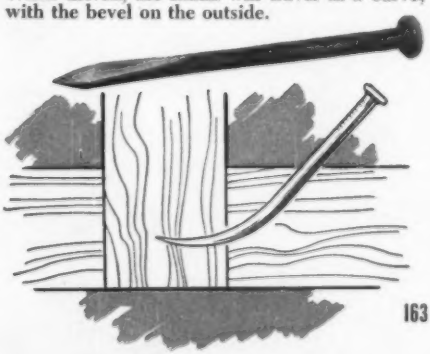
DOUBLE-HEAD NAILS are very handy for temporary fastening because the upper head remains fully exposed for quick removal. If you can't find a retail store that stocks such nails, make them yourself. Just slip hollow rivets over the shanks of common nails, as shown.



HOLDING STUDS FIRMLY IN PLACE while you toenail them to sills and plates is simple with this trick many pros use. Drive the side of a spike head into the horizontal member to form a temporary stop on the far side of the stud end. Hold the spike's shank down with your free hand or, when it's more convenient in the case of sills, place your foot on the shank.

WOOD SPLITTING when you try to drive nails into it? Try dulling the points with a hammer. If that doesn't work, clip them off with diagonal pliers or cutters. The resulting chisel points will generally cut through the fibers without spreading them.

ANOTHER GOOD TOENAILING TRICK: Joints will hold better if you file or grind a flat down one side of the nail, as shown in the sketch above. When driven, the shank will travel in a curve, with the bevel on the outside.



What to do

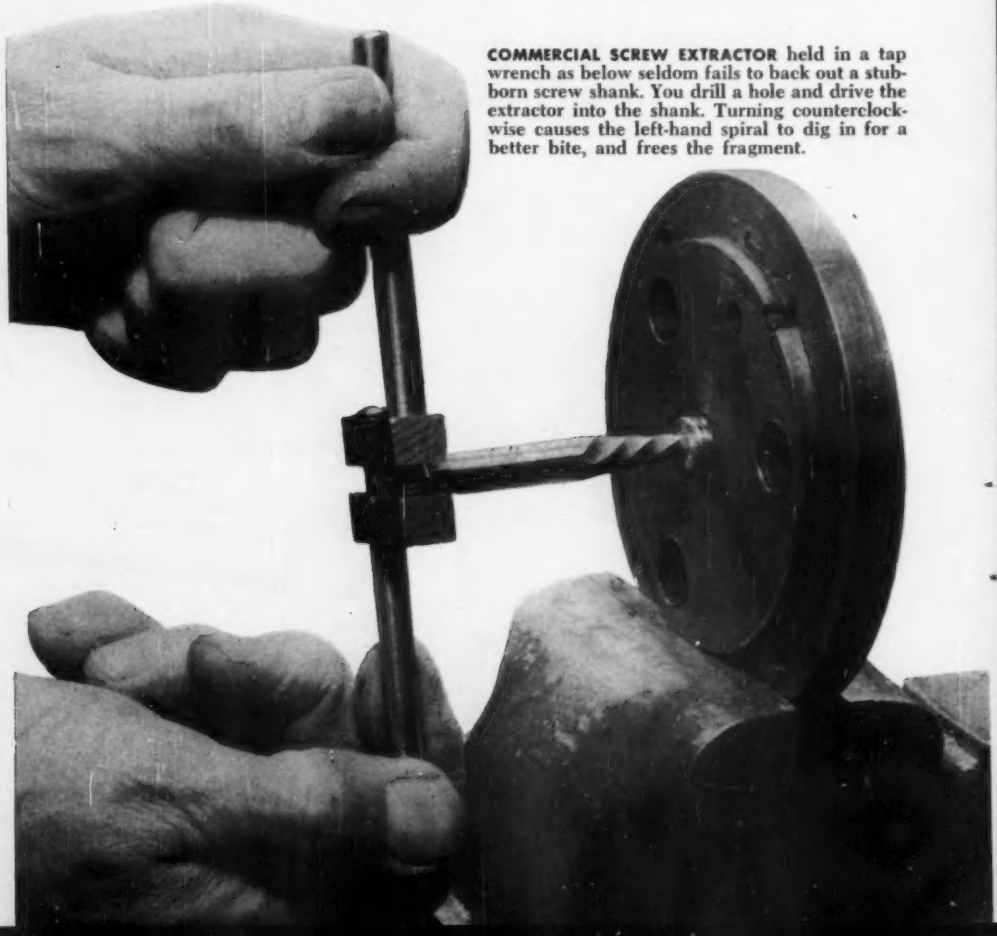
When a Screw Breaks in Its Hole

By Walter E. Burton

IT'S always a challenge when you come up against a screw broken off near the surface of the work. Backing out the stub may seem hopeless, particularly since the conditions that caused the break—rust, overtightening, strain, or friction on tight-fitting threads—usually set the screw firmly in the hole.

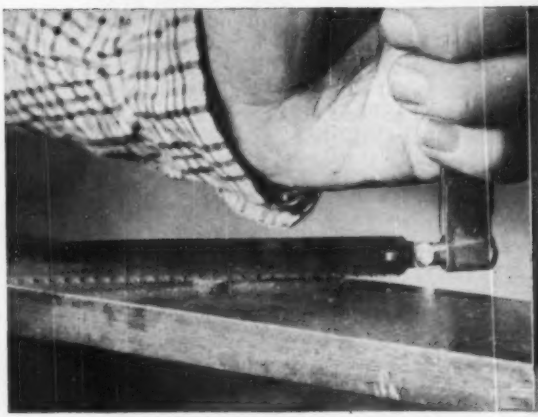
There are various ways of freeing and removing the stub. Choosing the right method is the important first step. Keep these points in mind when making your choice:

- Use a commercial screw extractor only if you have the right size. A small one will break before it will turn a heavy stub. They come in sizes ranging from 1/16″ to 2″.
- It's simple enough to drill out the stub with a drill slightly smaller than the screw shank. But if you waver or run off center, the threaded-hole will be damaged and a new screw of the same size won't hold. If the assembly permits the use of a larger screw, drilling is okay, as you can drill and tap the

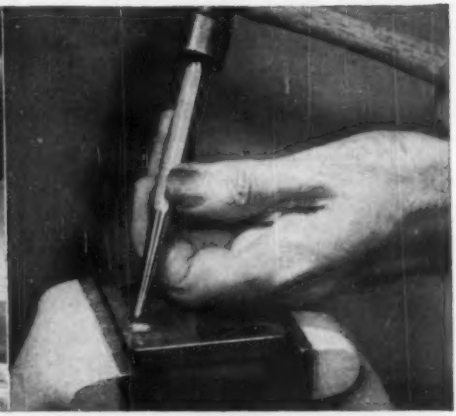


COMMERCIAL SCREW EXTRACTOR held in a tap wrench as below seldom fails to back out a stubborn screw shank. You drill a hole and drive the extractor into the shank. Turning counterclockwise causes the left-hand spiral to dig in for a better bite, and frees the fragment.

4 ways to remove a screw stub with ordinary shop tools

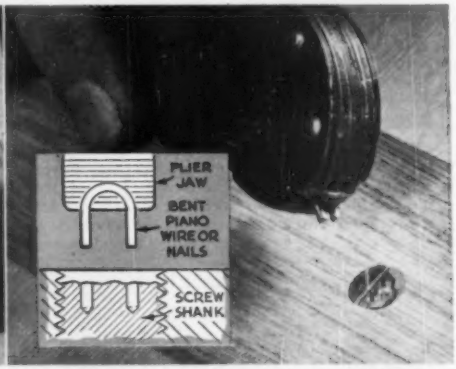


HACKSAW A SCREWDRIVER SLOT in the protruding shank of a screw that is broken slightly above the surface. Use a broad-blade screwdriver.



BACK OUT THE STUB with a hammer and punch held at a 65-degree angle near periphery. Tap the punch lightly to coax the stub into turning.

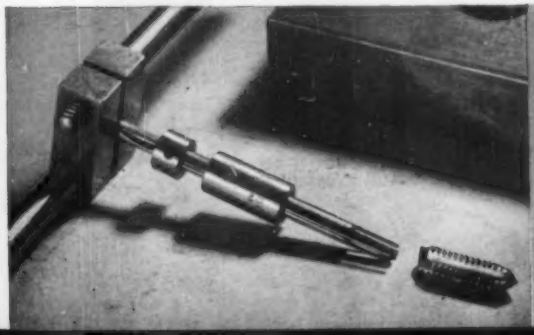
DRIVE THE BROKEN SECTION through the screw hole if the hole passes through the part. Redrill the hole, and tap for a larger screw.

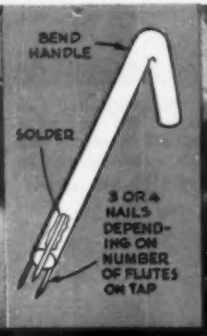


DRILL TWO SMALL HOLES in the top of the stub. Grip two similarly spaced nails in pliers, as above, insert them in the holes, and twist.

Simple outs for taps and dies

A TAP WILL BREAK EASIER and will be more difficult to remove than a screw because it is hardened and brittle. You can buy tap extractors made for various tap sizes and flute arrangements. Their steel prongs fit into the flutes to twist the tap out of the hole. Or you can make a tap extractor (sketch in center) by soldering three or four nails to a rod of suitable diameter. If a piece of rod gets stuck in a die while being threaded, use a jeweler's saw (as in photo below at right) to cut the rod into fragments small enough to remove easily.





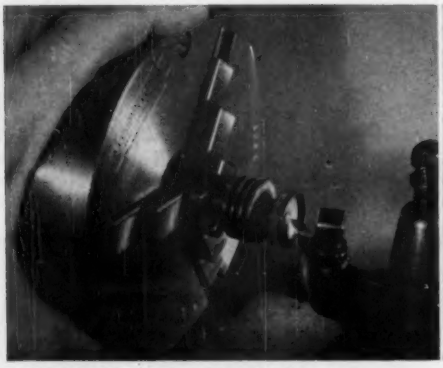
CONTINUED

damaged hole for the next larger thread.

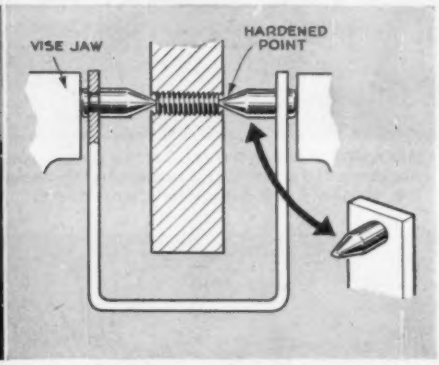
- You can solder a handle atop a shank that has broken flush with the surface. Solder carefully, though: If solder runs into the screw threads, you've doubled your trouble.
- Consider heat as a method of freeing a seized screw shank, but only if heat won't draw temper from a hardened part.
- A removal method that will work on a stub lodged in steel might not work with wood or soft metal. A drill might slip off the stub and bite into the softer material around it. Or torque applied to the top of the shank with a hammer and punch might cause the shank to bend in the wood instead of turning.

Whatever method you use, try to make the job easier by applying penetrating oil.

You can use some of the tricks jewelers use to remove screws

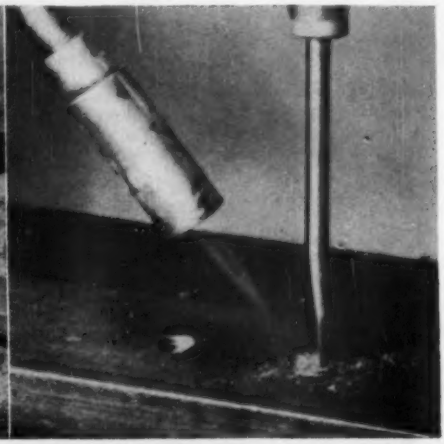


CHUCK A SMALL PART like this faucet stem in a lathe so the broken screw is centered. Force a sharp cutter bit into the screw end at three o'clock position, and turn the chuck by hand away from you (clockwise in the photo).



CLAMP THE SCREW IN A VISE if both ends are accessible, and rotate the part around it. Hardened points held in a bracket can be used to transmit vise pressure as shown; or insert a short length of rod in hole on each side.

SOLDER A HANDLE to the screw shank, and you can often wind it out. Flatten the end of a piece of drill rod and roughen it with a file before applying solder with a torch. Try to start the screw while the metal is hot.



USE HEAT to free a seized or rusted screw. Different metals expand at different rates, so play a torch over the part with a circular motion and try to twist out the screw while the metal around it is still expanding.

Short Cuts and Tips

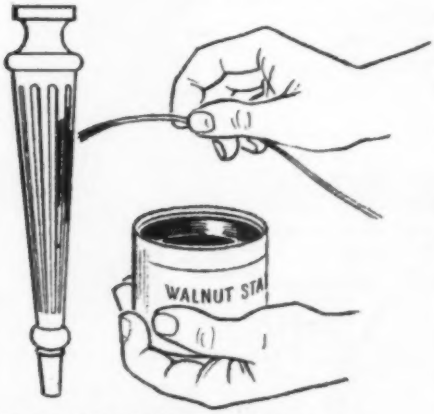
FROM PS READERS

Trash Burner Solves Debris Problem

THE trash burner I built doesn't have to be upended to clear out debris. It has an independent base welded from 1¼″ angle iron and expanded metal, and a top of similar construction. The burner body is a 55-gallon oil drum with both ends removed. Emptying accumulated ashes is no problem. I simply tilt the drum to one side.—*E. W. Kraft, South Chicago, Ill.*

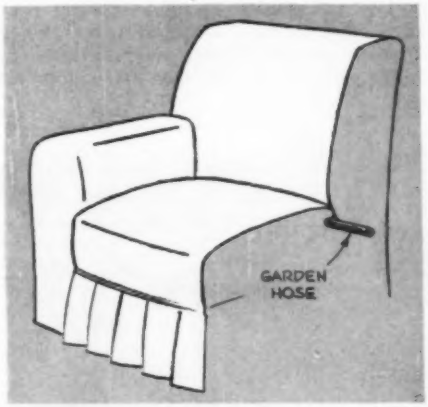
▶▶▶RUBBER heels salvaged from shoes about to be discarded make fine furniture protectors on doors. Screw the heels to the door bottoms and paint them to match.—*William Dore, Worton, Md.*

▶▶▶AN EASY way to strain paint is through steel wool placed in a can that has a few holes punched in the bottom. Dispose of the residue and can when through. —*N. Steigman, Howard Beach, N. Y.*



Rope Used for Touchups

INSTEAD of dirtying a paintbrush for a small touchup, try using the end of a piece of clothesline or other tightly woven rope. When the job's done, simply cut off the rope end and throw it away.—*Reath R. Brown, Hyde Park, N. Y.*



Anchoring a Sofa Cover

KEEPING a sofa cover from pulling out at the rear of the seat is a common problem. We solved it by tucking a length of plastic garden hose between the seat and the back, over the slip cover.—*G. A. Fritz, Caledonia, Wis.*

How to turn a set of

Lazy-Susan Bar Shelves

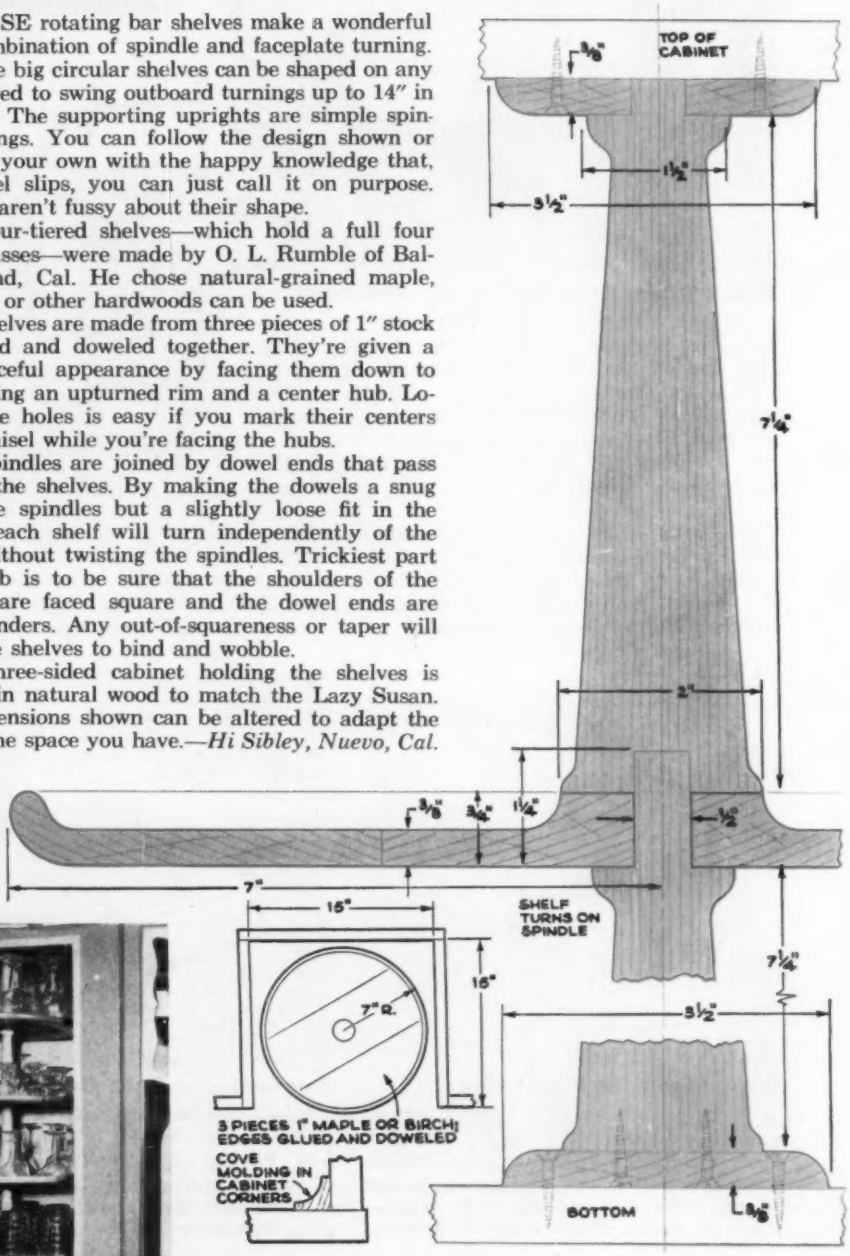
THESE rotating bar shelves make a wonderful combination of spindle and faceplate turning. The big circular shelves can be shaped on any lathe rigged to swing outboard turnings up to 14″ in diameter. The supporting uprights are simple spindle turnings. You can follow the design shown or make up your own with the happy knowledge that, if a chisel slips, you can just call it on purpose. Spindles aren't fussy about their shape.

The four-tiered shelves—which hold a full four dozen glasses—were made by O. L. Rumble of Balboa Island, Cal. He chose natural-grained maple, but birch or other hardwoods can be used.

The shelves are made from three pieces of 1″ stock edge-glued and doweled together. They're given a slim, graceful appearance by facing them down to ⅜″, leaving an upturned rim and a center hub. Locating the holes is easy if you mark their centers with a chisel while you're facing the hubs.

The spindles are joined by dowel ends that pass through the shelves. By making the dowels a snug fit in the spindles but a slightly loose fit in the shelves, each shelf will turn independently of the others without twisting the spindles. Trickiest part of the job is to be sure that the shoulders of the spindles are faced square and the dowel ends are true cylinders. Any out-of-squareness or taper will cause the shelves to bind and wobble.

The three-sided cabinet holding the shelves is paneled in natural wood to match the Lazy Susan. The dimensions shown can be altered to adapt the unit to the space you have.—*Hi Sibley, Nuevo, Cal.*



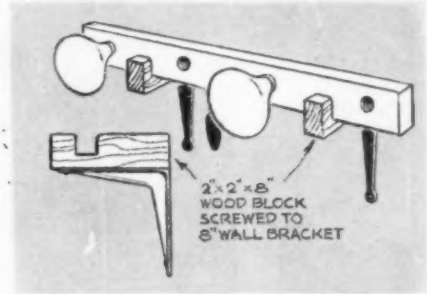
Short Cuts and Tips
FROM PS READERS

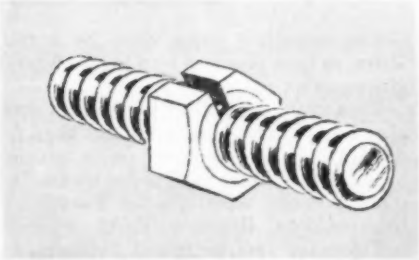
Ring Behind Chuck Makes Power Tapping Safe

WHEN tapping small holes in work held in a lathe, you can avoid tool breakage by slipping a collar over the taper shank of the drill chuck. Machine it to just the right thickness to prevent the shank from seating tightly in the tail-spindle socket. Bring up the tailstock, lock it, and advance the feed while gripping the chuck firmly by hand. If the tap grabs, let go of the chuck and allow it to spin until you can shut off power and back it out.—*R. C. Gallant, Tulsa, Okla.*

Wall Rack for Bar Lights

MOVIE-CAMERA bar lights are out of the way and safe when they're hanging on an easy-to-make and inexpensive rack mounted high on a closet wall. All you need is a pair of 8″ shelf brackets and two wood blocks, each 2″ by 2″ by 8″. Cut a slot in each block, about an inch from what will be its outer end, to provide a seat for the body of the bar light. Then screw the blocks to the brackets, and the brackets to the wall at stud centers.—*Harold Garvey, Dallas.*





Slotted Nut Protects Threads

WHEN I have to clamp the shank of a bolt in a vise, I thread on a slotted nut. As jaw pressure closes the slot, the threads are gripped firmly but safely.—*R. Stille, Rio De Janeiro, Brazil.*

Bench Doubles as Sawhorse

DEEP V notches cut in the legs of a utility bench make it a useful sawhorse. The notches cradle lumber securely against slipping while it's being cut.—*Ann Zawistowski, Coon Rapids, Minn.*

A sun-powered transistor amplifier makes this a—

Space-Age Crystal Set

By D. S. Halacy Jr.

LIGHT-POWERED RADIO plays indoors under artificial light, too. Performance is boosted by connecting antenna to TV aerial or telephone-dial finger stop; a short length of wire, with alligator clips at the ends, helps.

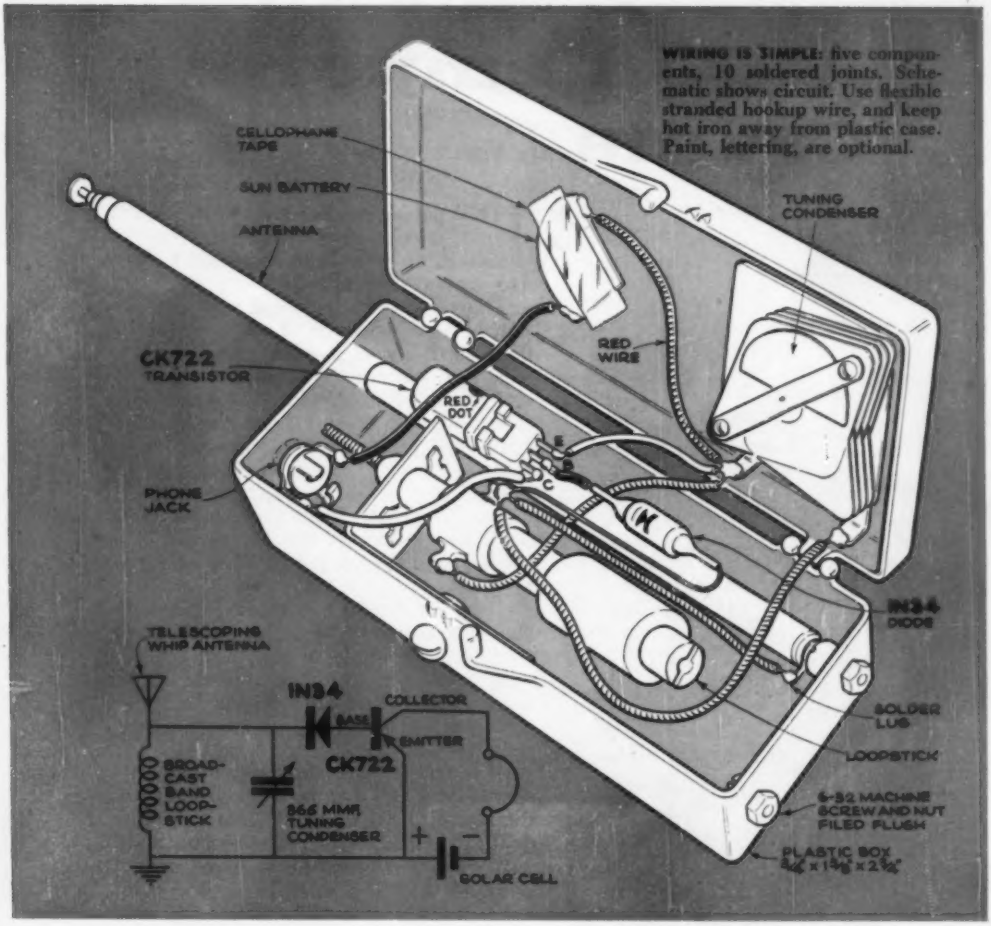
THIS tiny radio puts satellite technology in the palm of your hand. Like radios in artificial moons, it's powered by the sun—or any other light.

Basically, it's a 1960-model crystal set. A rugged sealed-in-glass diode has replaced the shaky catwhisker and galena crystal. The usually faint crystal-set signal is magnified many times by a transistor, in turn powered by a high-efficiency silicon solar cell.

This unit—and other parts—can probably be obtained locally for less than five dollars. All are standard parts, stocked by most retail and mail-order shops. In a pinch you can substitute the less-efficient International Rectifier B2M selenium cell for the quarter-round section of a Hoffman silicon solar battery.

First steps. Best place to begin construction is with the case for the radio—a small plastic box. You may find one in the medicine chest or at the druggist's. Start the necessary holes with a hot ice pick, then file or ream to size. Keep try-

Author Halacy is an expert on the sun. A couple of years ago he wrote Fabulous Fireball, *a book that tells the story of the sun and solar energy. Last fall, Macmillan also published his* Fun with the Sun, *a book describing how to make seven solar-energy projects at home. The present article is an outgrowth of his research for the latter book.*



ing the part as you enlarge the hole, to insure a snug fit.

The case can be painted or left transparent. The one pictured has a finish of Day-Glo spray paint, applied to the outside of the case. The paint softened the plastic slightly and created a wrinkled finish.

The hinged top is left clear and a piece of painted bond paper cut to fit inside. This paper was lettered, and cut to accept the dial shaft and solar battery. The lettering is pure whim—there's no trademark or commercial name.

After painting, go ahead with the assembly. Set the antenna mounting base through the bottom hole, put on the nut, cut off excess threads, and file smooth. Add a 6-32 screw and nut to the other side if you expect the radio to stand up.

Condenser and battery. Install the tuning condenser in the hinged top by first removing the dial and the small flathead screws. Remove both hex nuts; use one on the outside to hold the condenser in place. Then mount the dial and twist the silver center screw thumb tight. Place the solar battery in position over the opening in the bond paper, and fasten it in place with a strip of cellophane tape.

Bend the loopstick mounting bracket as shown, snap the loopstick in place, and fasten the bracket with a 6-32 screw and

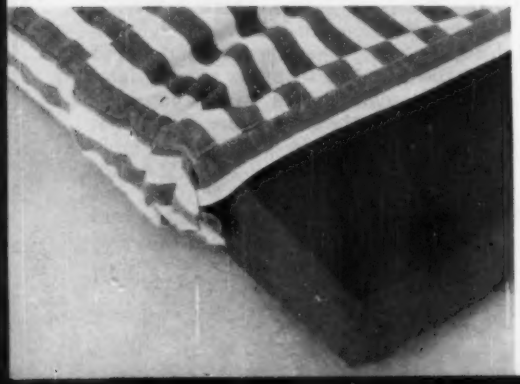
[*Continued on page 230*]

How to build an heirloom of the future:

A Contemporary Cradle

By Mac L. Olds

SUSPENDED between two A frames, cradle rocks easily. A hook on the end panel engages screw eye in the side rail to prevent unauthorized rocking. Mattress is made of urethane foam; slab need be but 1" thick. Cover can be pillow-case type, or fitted and zippered.



LIKE babies, cradles are too well liked to remain in oblivion. Here's a design as up to date as plastic bottles and instant cereal.

The cradle is suspended at a convenient height. If desired, it will rock on the floor as easily as it swings on its bipod legs. And it's not too large to be unhung and tucked into a station wagon. Practice proves the inward sloping sides effectively foil young adventurers who try to climb out.

First step in constructing the cradle is making the legs. I cut mine from slabs made by laminating two 1" boards. This helps prevent warp, but 2" stock could be used, too.

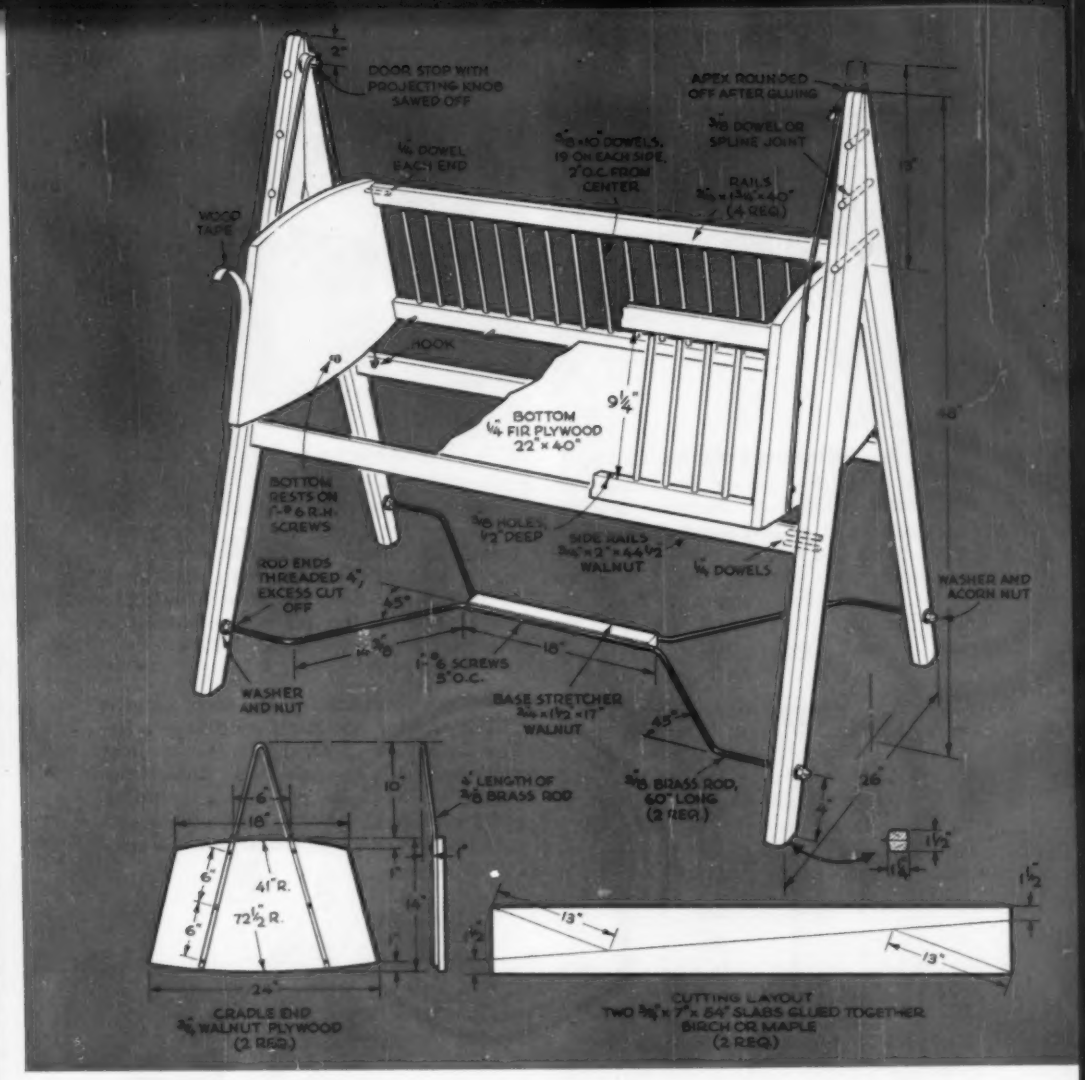
The legs should be planed to finished shape before they are glued. Plane all four legs uniformly at the joint so that each pair will spread symmetrically. I used straight-through dowels to join them; blind dowels or a splined joint also could be used.

After the legs are glued, lay a straightedge across them at floor level and trim the legs evenly. About 4" from the ends, drill for the 3/8"-brass-rod stretcher.

When assembling the rails, allow 1/8" extra depth in the dowel holes. Trim the two dowels in each side rail to 7/8" and bore matching holes 1" deep in the legs. Dowels at the ends of the cradle rails should be cut to 3/8", and fitted into 1/2"-deep holes in the end panels.

Bending the brass rod for the hangers and the leg stretcher is simplified by using a pipe handle. Place the rod in a vise, jaw edges at the mark for the bend, and slide a 1/2" pipe over the extending rod. This will give additional leverage, and will make the bends sharp and uniform.

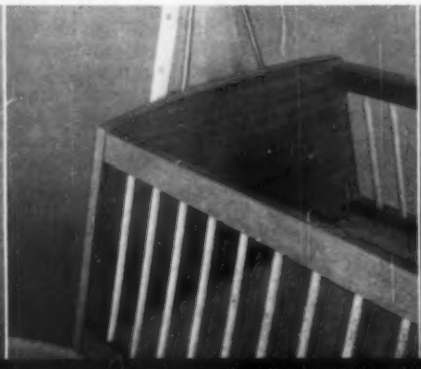
A slab of urethane foam with a zippered slip cover makes a good mattress for the cradle—it can be washed easily and it dries fast. The mattress rests on a bottom panel of 1/4" plywood, cut to fit snugly within the sides.

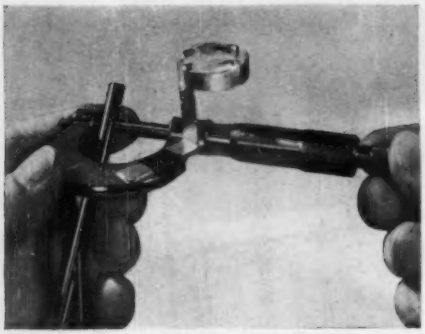


DOOR STOPS, of the type that are screwed to the floor, make swing pivots. Remove rubber bumper, cut off knob, then file smooth and touch up with gold paint to match rod hangers.

CRADLE SIDES repeat leg angle and are set slightly inboard of end-panel edge. Plywood bottom panel rests on projecting heads of 1"-#6 screws, three on each side, one at end.

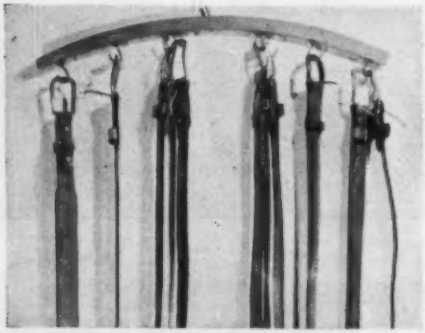
OFFSET in suspension rods gives clearance for removing cradle, or swinging out over rails. Cradle can be removed and placed on floor; curved end panels permit rocking without hangers.





Lens for Micrometer Reading

YOU'LL get accurate measurements faster if you attach a magnifier to a micrometer. Cut a T-shaped frame from sheet brass and roll the cross bar to hold an inexpensive surplus lens. Use a few drops of cellulose cement to bond the two. Bend up the leg and tape it to the tool.—*Martin Kent, Detroit.*

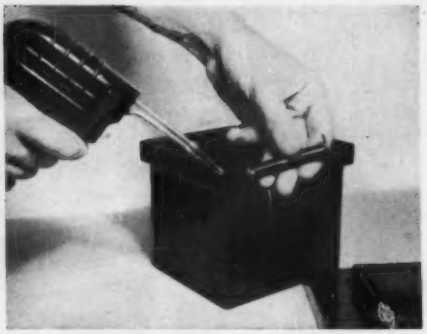


Belt Rack from Cup Hooks

SCREW six cup hooks to the underside of a coat hanger and you have a space-saving rack that makes belt selection easy.—*Hartwell Hughes, Inglewood, Cal.*

Keeping Ladder Rungs Clean

ANNOYED by mud carried onto ladder rungs by my shoes, I attached a stout shelf bracket to the inside of one bottom rail section for use as a convenient scraper. —*G. E. Hendrickson, Argyle, Wis.*



Film Spool Mends Plastic Tank

HERE'S an easy way to mend a crack in a plastic film-developing tank or tray: First sand the damaged area. Then hold a plastic film spool against the surface and apply the heat of a soldering gun or torch to melt it and flow the material into the crack. The repair will be permanent.—*John A. Comstock, Wellsboro, Pa.*

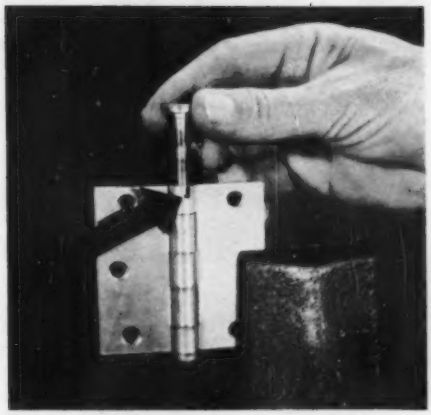
▶▶▶HEAT conducted along short lengths of wire solder can burn your fingers before a job is finished. To avoid this, drill and slit a small cork. Insert the solder at the most convenient gripping point and you'll have a comfortable and safe handle.—*George Henderson, Chicago.*

Salvaging Spray-Gun Cleaner

WHEN running thinner through your spray gun to clean it, reduce the fire danger—and save the solvent—by slipping a piece of tubing over the nozzle. Besides directing the spray into a container, the tubing causes most of the spray to condense and emerge as a small stream. Save the thinner. It can still be used later to reduce paint.—*Edward Bentley, Jackson, Mich.*

Short Cuts and Tips

FROM PS READERS



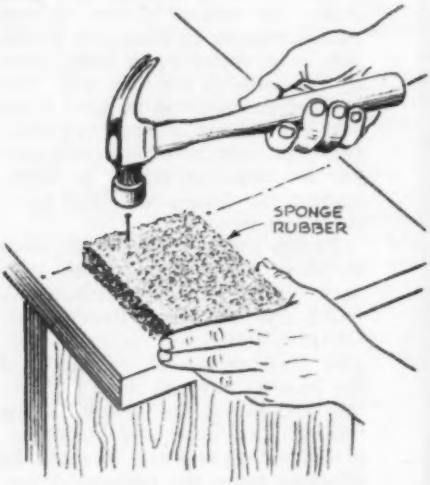
Slot for Hinge-Pin Removal

BEFORE mounting hinges, file slots in the tops of their barrels and you'll have no trouble getting a screwdriver under the caps if you have to remove the pins later.—*R. J. De Cristoforo, Los Angeles.*

Aid to Model-Plane Assembly

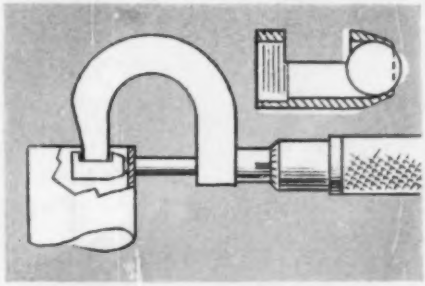
A PIECE of Celotex placed under model airplane plans is helpful. It makes it easy to insert the straight pins used to hold parts in place until the cement is dry.—*J. G. Lownsbery, Richmond, Va.*

▶▶▶WASHING hardened grease and dirt from crevices in small parts can be made easier with the air jet from an old insect sprayer. Remove the tank and solder a 1/4″ tube to the sprayer's outlet. Now pump. The air jet will agitate the solvent, working it through the parts.—*John P. Vertrees, Madras, Ore.*



Sponge Rubber Starts Nails

STARTING small nails and brads by driving them through a flat pad of sponge rubber not only gives them good support, but also provides a protection shield for the surface of the work. The resiliency and porous texture of the rubber lets you drive the shank section practically home before lifting the pad back over the head and finishing with a nail set.—*Daniel Bousha, Jackson, Mich.*

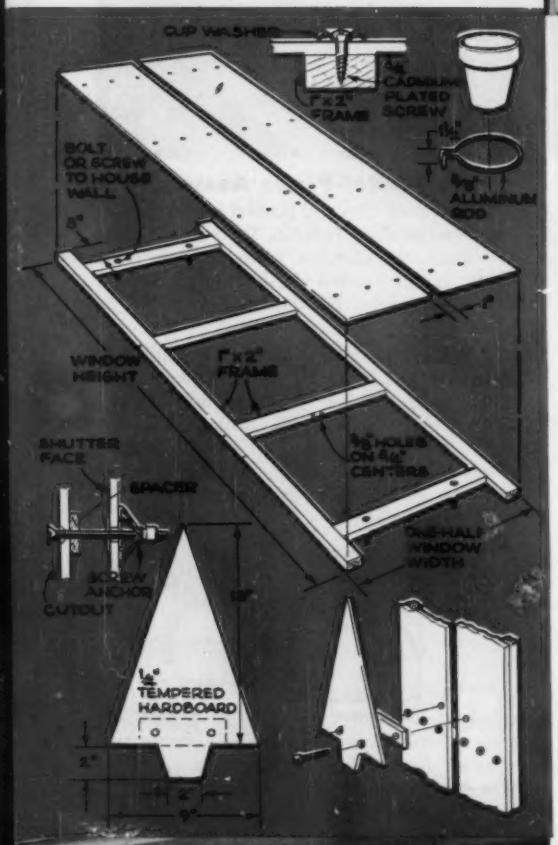


Easy Way to Mike Tubing Walls

WITH a bearing ball and a section of tubing just large enough to receive it, you can make a tubing-wall measuring adapter for a micrometer. Taper one end of the tube to .010″ and roll it inward enough to retain the ball. Tap the other end for a retaining screw and file out a clearance opening at center. Insert the micrometer frame for readings, deducting the ball's diameter.—*F. Murray, Chicago.*

Dress up your windows with

Hardboard Shutters



DESIGNED to add a distinctive touch to any house, these durable shutters are made of one-by-twos and either 1/4" tempered Presdwood (smooth surface) or one of the textured-hardboard sidings with grooves or vertical striations.

Cut all parts for the ladderlike frames from one-by-two stock, and make each overlying hardboard panel 1/2" narrower than half the frame width, to provide a 1" gap down the center of the shutter. Start assembly by attaching the inside cross members of each frame to the vertical runners with glue and galvanized finishing nails. Next, with the top and bottom cross members positioned between the runners, *but not attached,* place the frames against the house wall and mark their locations.

Fasten the top and bottom cross members to a masonry wall with lead anchor plugs and countersunk flathead screws. Use flathead screws for walls with wood siding or shingles. Nail and glue the remainder of the framing units to these horizontals and attach the panels to the frames with glue and cadmium-plated screws and cup washers. In all cases paint the unexposed surfaces of shutter parts before putting them up. Finish outside surfaces with primer-sealer and two coats of exterior trim paint.

As a final note, accent each shutter with either a flowerpot holder formed from 3/8" aluminum rod, or an appliquéd design cut from 1/4" tempered hardboard and secured to the panels with screws and molly fasteners.

know-how file

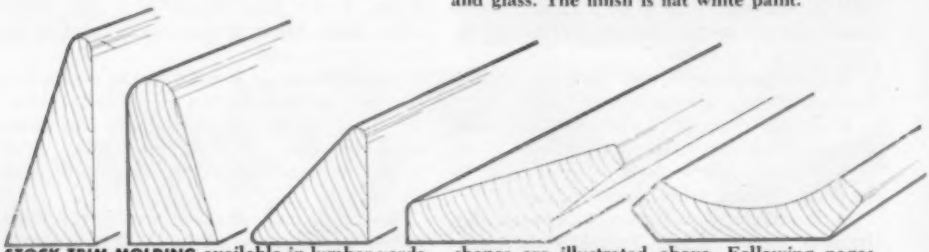
How to Frame Any Picture

ANY picture that merits space on your walls deserves to be shown off to its best advantage. Its frame should be a harmonious and unobtrusive background for the picture.

Ideally, a picture frame should be custom-made for the subject it is to enhance. This is the best argument for making your own picture frames. You'll get what you want. Besides, it's easy—and you'll save money.

The tricky part is deciding on the right frame for a particular picture. Your best bet is to look for an attractively framed picture like it in a furniture showroom, a department store, or the public library. Make a sketch of the molding cross section and look for it in your local stores or lumber yards. With the variety of stock moldings available, the toughest part of the job is often done for you.

SHALLOW BOX makes a severe frame for this matted dockside scene. Rabbet cut in rectangular-section hardwood molding holds both print and glass. The finish is flat white paint.

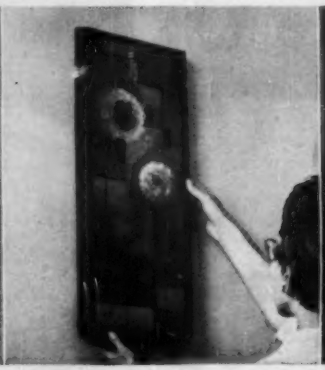


STOCK TRIM MOLDING available in lumber yards is best source for raw framing material. A few shapes are illustrated above. Following pages show how to adapt them for framing.

CONTINUED

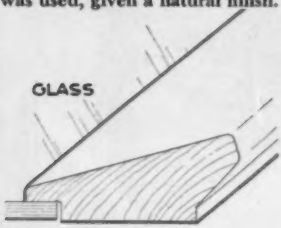
How to match the frame style to the picture

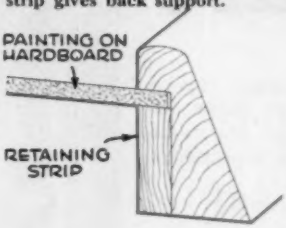
BEVELED MOLDING frames a matted photoprint mounted under glass. Wormy cedar shiplap was used, given a natural finish.

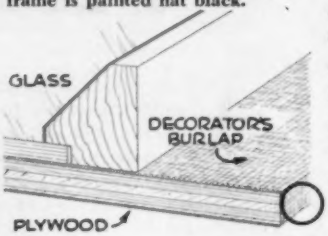


ABSTRACT OIL is close-framed in narrow hardwood molding, finished in deep brown. Retaining strip gives back support.

BACK MOUNTING of plywood covered with decorator's burlap dramatizes this print. Narrow frame is painted flat black.







Interior decorators today prefer simpler arrangements of pictures in a room—groupings, usually—instead of the scattered clutter that was in vogue some years ago. You see fewer modern frames with elaborate carving or curlicues or gold-leaf overlay. You see many attractive frames that are narrow, simple, unobtrusive—a boon to the frame-it-yourselfer.

How do you choose a picture frame? First, consider how the picture looks in the frame. Then consider how the frame fits its surroundings when the picture is hung. As far as the picture is concerned, here are a few rules:

- Oil paintings are nearly always framed close, without a mat.
- Prints usually are matted and framed with very narrow molding.
- Water colors lend themselves to large mats and wider moldings.
- Pastels and water colors are usually framed under glass. Prints sometimes. Oils never.

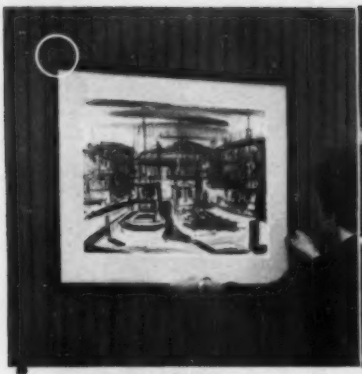
Picture-frame molding. If you have an old frame with the kind of molding you want, chop it up and reassemble it in the size you need.

Some hardware stores carry an assortment of unfinished molding made for picture framing. Cost varies widely, averages about $1 for a 3′ length.

Your best source of supply, however, is the local lumber yard. Take a look at the racks of ordinary builder's trim moldings. These stock, mill-run moldings come in dozens of sizes and cross sections. You'll find coves, drip cap, bullnose strip. Most of them are suitable for picture framing.

All it needs is a rabbet. On a circular saw it's no trick to run a ¼″-deep rabbet for the picture and glass along the inner edge of the molding. A router, drill press, or hand-rabbeting plane will also do the job.

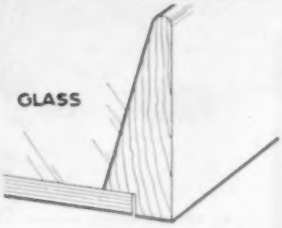
Mitering can be done accurately with either power or hand tools. If you use a bench saw, see that the blade is sharp.

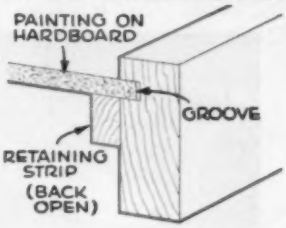


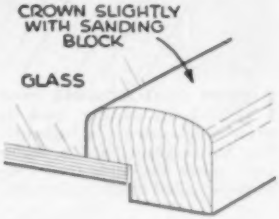
WEDGE-SECTION HARDWOOD was used for this frame. Thick, beveled mat sets off water color. The finish is flat black paint.

SOFTWOOD LUMBER STRIPPING, in natural finish, box-frames a large oil painting. Dado cut was used. Note retaining strip.

WIDE-MARGIN MAT is another way to dramatize a small print. Narrow frame is finished in honey-toned mat lacquer.



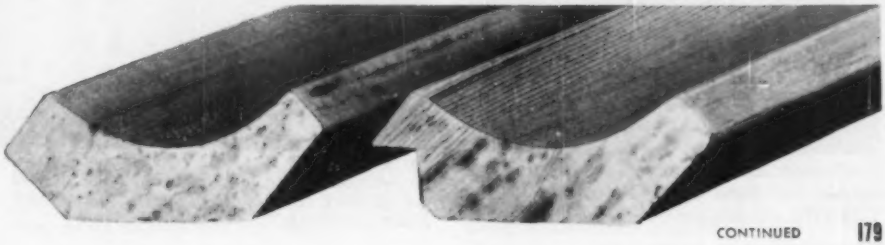




Push the work into the saw slowly to avoid side slippage.

If you have neither a bench saw nor a miter-box-and-backsaw outfit, improvise a right-angle miter box from scrap lumber. Nail two-by-twos to a piece of plywood (see drawing on following page). To use it, rough-miter two lengths of molding. Then wedge or clamp them, ends butting, in the box and recut the joint. The saw

UNMATTED WATER COLOR looks handsome in a frame put together from stock cove molding, shown below at right after rabbet had been cut. Finish is flat wall paint. There's no glass.



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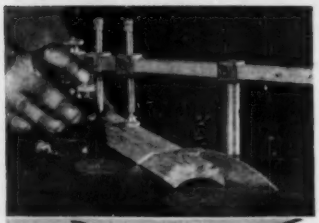
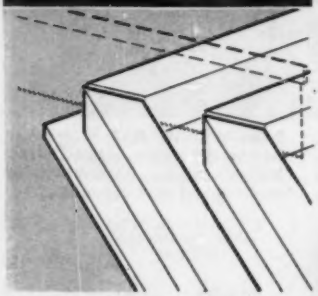
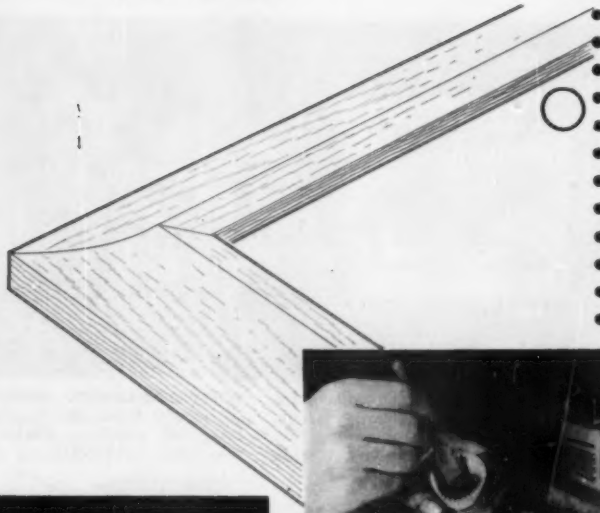
How to make the frame





1 MITER COVE MOLDING front side down as the back is often rough-sawn (top photo). For handsawing, use a right-angle miter box made from two-by-twos nailed to scrap plywood.

2 CUT RABBET that holds picture and glass about ¼" deep. This converts most trim molding into picture-frame stock. In some cases a dado cut will serve the same purpose.



3 EPOXY RESIN is easiest for gluing miter joints. If joints are accurately cut, mix only resin and catalyst, as shown above. If they are rough, add a little filler to the mixture.

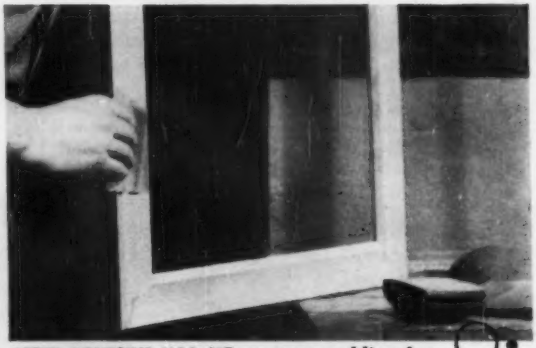
kerf will true the miter on each piece.

If the shape of the molding permits, reinforce the corner joints with pins. Use finishing nails with the heads clipped off.

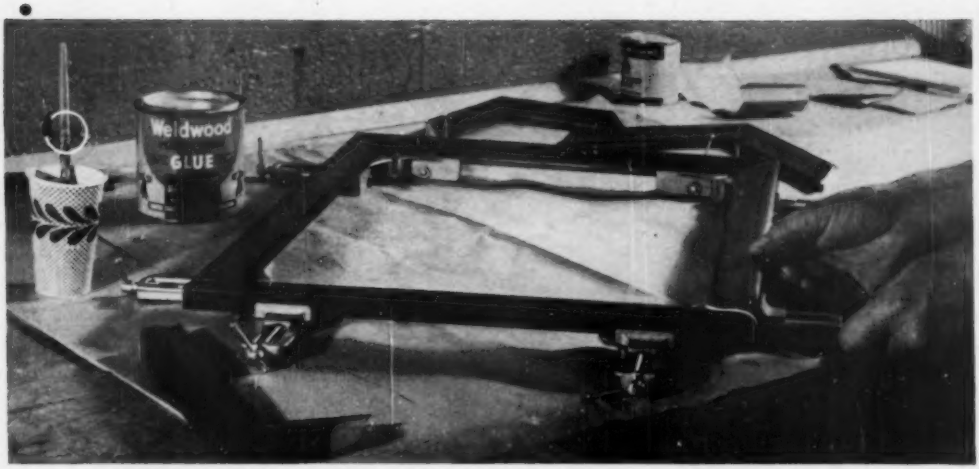
Joining the frame. Epoxy resin is the best adhesive to use. You can buy it in bulk, or you can get a small quantity in one of the $1 patching kits sold in hardware stores (read the label to be sure that the resin in the kit is epoxy, not polyester). In addition to resin and catalyst, some kits include a powdered metal filler. If the frame joints are exactly mitered, cement them with resin and catalyst mixed without filler. Fine sawdust will serve as a substitute filler. Clamp the joints lightly and let the resin cure thoroughly.

Conventional animal glues or urea resin call for tight clamping of the joints. Use either commercial corner clamps, or

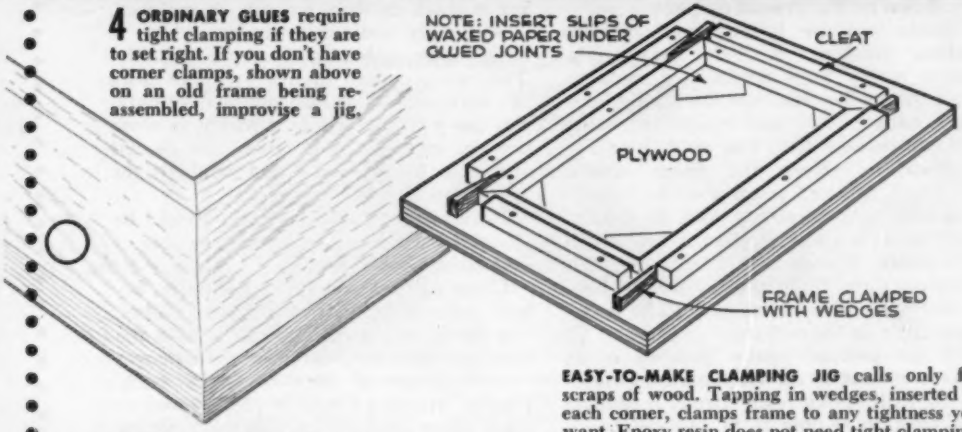
Steps to be followed in



AFTER ADHESIVE HAS SET, go over molding for imperfections. Use filler where needed. Round out all sharp outer edges slightly with fine sandpaper. Surface-putty the miter joints.

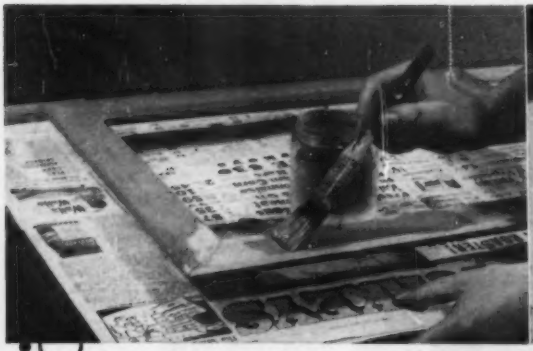


4 ORDINARY GLUES require tight clamping if they are to set right. If you don't have corner clamps, shown above on an old frame being reassembled, improvise a jig.



EASY-TO-MAKE CLAMPING JIG calls only for scraps of wood. Tapping in wedges, inserted at each corner, clamps frame to any tightness you want. Epoxy resin does not need tight clamping.

finishing the frame

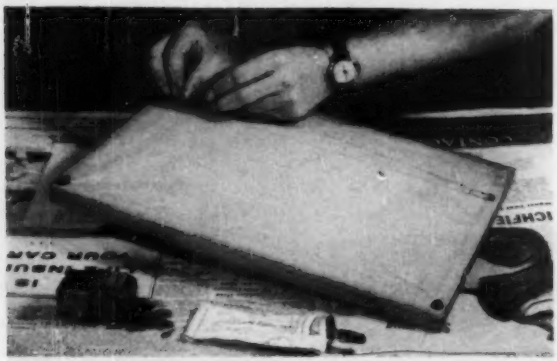


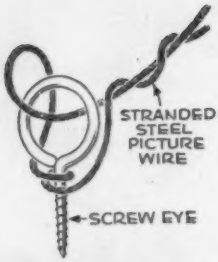
DEAD-FLAT WALL PAINT looks good on softwood frames, such as this cove-molding job. Try a muted shade of the dominant color in the picture. Avoid finishes with any gloss.

RUBBED-IN LIGHT-COLORED FILLER, tinted with oil color, makes a handsome finish for hardwood frames. When filler dries, spray the frame with a coat of mat acrylic lacquer.

CONTINUED

Paper backing and hanging





PASTE WRAPPING PAPER on the back to keep out dust. Rubber-head tacks at lower corners space picture from the wall. Attach picture wire to small screw eyes as shown above.

make a clamping jig from scrap lumber as shown on the preceding page.

Since you are joining your molding before finishing it (the commercial frame maker buys prefinished molding, then miters it) you can fillet inside corners with putty, and round off sharp outside corners with fine sandpaper.

Finishing. Keep the finish simple. Ordinary flat wall paint gives a frame a pleasant, unpretentious look that is in keeping with many modern living rooms. Hardwood frames are attractive when rubbed with light-colored wood filler tinted with oil color matching the dominant color in the picture.

If the picture you're framing is on paper, mount it on chipboard or hardboard with epoxy resin. Brush a coat on the backing. Allow it to become tacky before smoothing down the picture.

If you're using a mat, slice a beveled cut-out for the picture with a sharp knife, cutting along a steel straightedge. White or cream-colored mat board is sold in art and stationery stores. You can get it thick or thin, smooth or textured.

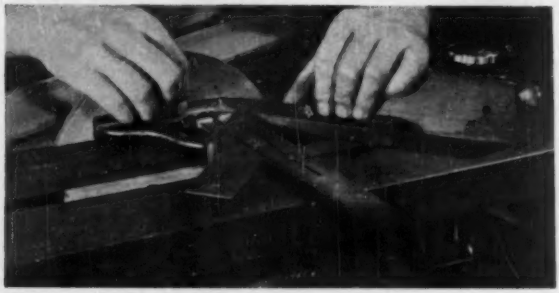
Although ordinary window glass is satisfactory, special glasses are available. They are premium quality—without flaws or waviness—and priced accordingly. For use with pictures that will be in close contact with the glass, there are special etched or coated panes that subdue light reflections.

Prints framed without glass should be sprayed with several protective coats of mat-finish acrylic lacquer.

Clean picture and glass, naturally, before putting them in the frame rabbet. Use brads or glazier's points to hold the assembly in place, and paste a dust cover —kraft paper is fine—over the back. Finally, attach a length of picture wire to small screw eyes driven into the molding near the picture top, but not so high that wire and wall hanger show.

Chances are, when you hang the picture, that your friends won't be able to tell it from a professional job.

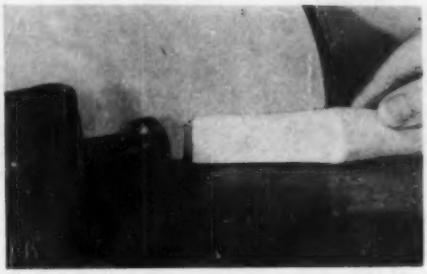
How to set your miter gauge accurately



CHECK MITER-GAUGE SETTING before cutting or disk-sanding molding joints. Hold a combination square against the saw or disk, and a try square against the miter gauge. Sliding the gauge until the squares meet shows up any inaccuracy.

Repairing a Hammer

NEW HICKORY HANDLE of same shape and size as original should be bought if old one breaks or loosens. Trimming it to fit is easiest with a disk sander, but can be done with a sanding block. Remove wood a little at a time until you can drive handle all the way into the head. Drive fitting will then leave slight glaze on high spots, showing where to sand further. Don't try to burn old stump out of head; bore it out with a drill.



Making a new handle safe and secure

ADD STRENGTH by coating handle with one of the newer rubber or epoxy cements before inserting it into the eye of the head. The glue will prevent the head from flying off even if wedges come loose.

WOOD WEDGE is fitted into a diagonal slot cut with a saw before handle is driven home. The slot should be deep enough to extend two-thirds of the way into hammer head. Sand wedge to thin edge.

DRIVING WEDGE with a bar clamp lets you seat it gently without danger of splitting as when you use a mallet. Ready-made wedge kits consisting of one wood and two metal wedges can be bought.

DRIVE TWO METAL WEDGES across wood wedge but without precut slots. Use ball-peen hammer, then file ends smooth. New hammer at right shows how it's done at factory.

DOWELS SPLIT IN HALF wedge handles in heads with rounded, tapered eyes. Sand dowel halves to a snug fit, glue them in, then insert regular wood and metal wedges.

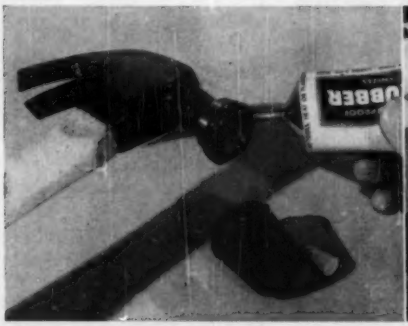
CONTINUED

Restoring the head of a damaged hammer

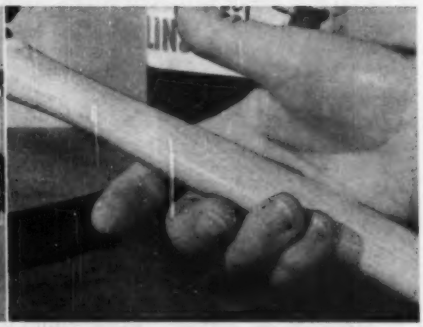
GRIND DOWN BATTERED EDGES when claws will no longer grip nailheads. Rough-grind face of hammer same way, then finish smoothing entire head with a fine-cutting hand file.

DAMAGED BALL FACE on ball-peen hammer can be smoothed with rubber suction cup chucked in electric drill. Use valve-grinding compound or faster-cutting paste abrasive in cup.

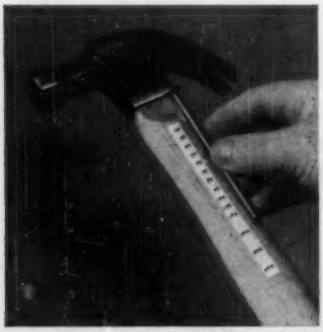
Finishing touches that add usefulness to your hammer



GIVE HAMMER A RUBBER FACE in two ways. Rubber crutch tip slipped over head cushions it for soft work. Or coat head with liquid rubber, which can be peeled off later.



BEST FINISH for new handle is a few drops of boiled linseed oil, well rubbed in with palm of hand. Before oiling, handle can be identified with a rubber-stamp impression.



SIZE	LENGTH
2d	1"
3d	1¼"
4d	1½"
5d	1¾"
6d	2"
7d	2¼"
8d	2½"
9d	2¾"
10d	3"
12d	3¼"
16d	3½"
20d	4"
30d	4½"
40d	5"

SCALE FOR MEASURING NAIL SIZES is handy and easy to stick on with clear cellulose tape. Use the lengths shown in table at right, and type or letter the scale on white paper.

THUMB REST cut from black tape and fastened near end of a new handle makes it easy to grip quickly and correctly. It also trains beginners, who hold it too near head.

Tuning Up a Warm-Air Heating System

By Edwin M. Field

THE best warm-air heating system may be like a new car—it may represent the latest design, the highest-quality equipment, yet it still may not run quite right. It puts out enough total heat, but it does it unevenly. First the house is too hot; then it's too cold. In one room you swelter; in another you freeze. Tornado-like gusts of hot air roar through the ducts while cold drafts chill you.

Two simple tune-ups will put an end to this wasteful, haphazard heating. The first adjustment is called CAC, or "Constant Air Circulation." The idea here is to set your system so that on a cold day it circulates *warm*, not hot, air almost continuously through your home. This constant heat eliminates uneven temperatures and uneconomical huffing and puffing on the part of your furnace.

You determine CAC by taking your system's temperature—once at the warm-air supply duct and once at the cold-air return duct. You jab them with a kitchen cooking thermometer of the type that's poked in meat. Then you set the fan speed so that the difference in the two temperatures neither goes above nor falls below about 90 degrees.

If air returns to your furnace too fast, it arrives too hot, wasting valuable unused heat. If it returns too slowly, it arrives too cold and your furnace labors to reheat it. At the proper temperature differential, your furnace purrs contentedly all the time.

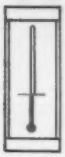
You are now ready to make the sec-

CONTINUED

ond adjustment. This is to balance temperatures throughout your home so that every room is equally comfortable, *although not necessarily equally warm.* By adjusting dampers and registers, you can set each room temperature individually. Often a cold room can be made warmer by cooling off another room that's too hot.

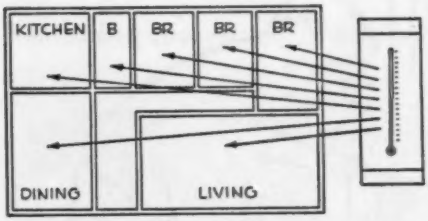
For this, you need only enough inexpensive thermometers to hang one in each room while you make adjustments. None of the adjustments suggested requires touching the furnace itself. Follow the steps shown and you'll be surprised at the comfort—and thrill—you can get from tuning up your own heating plant.

How to set temperatures for comfort anywhere in the house



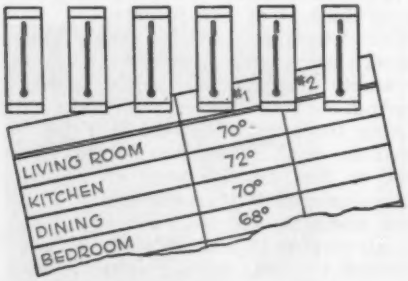
1 Choose a day when outside temperatures are 40 degrees F. or less and winds are gentle.

2 Set your thermostat to its normal temperature.



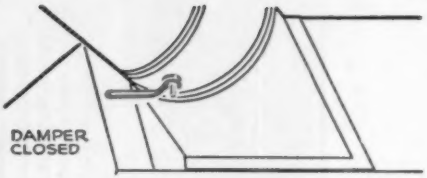
3 Assemble a number of inexpensive but accurate small thermometers and hang one in the center of each room about four feet above floor level.

4 Allow your heating unit to operate awhile to insure a thorough circulation. Make certain there are no obstructions in front of your registers.

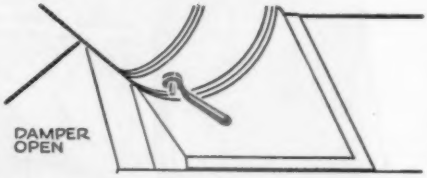


5 Read the thermometer in each room and record the results.

6 If a room is hotter than you desire, reduce the warm-air delivery. Partially



close cellar duct dampers or room registers.

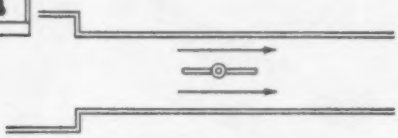


7 If a room is cooler than you desire, increase the warm-air delivery. Partially open duct dampers or room registers. Work gradually, as too marked a change of any one damper or register will change the heat flow to all others. You may have to rerun this test a number of times until each room is at exactly the temperature you want.

8 Sometimes even opening a register or damper wide won't increase heat flow sufficiently. In this case, adjust your other rooms first, as closing down some of these registers should supply an additional quantity of warmed air to the cold room. If all attempts fail, you may assume: (1) that the duct or register is too small to carry the heat load; (2) that the duct travels through a cold air space and needs insulation around it; or (3) that the room register is too far from the furnace or main trunk supply line for efficient heat distribution. Your heating serviceman can help you remedy this situation.

How to balance air speed for best circulation of heat

1 Choose a day when outside temperatures are 40 degrees F. or less. This way, your home will not become overheated.

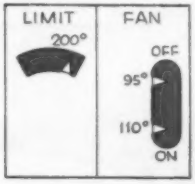


2 Open all registers and dampers.

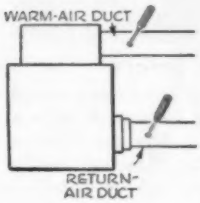
3 Be sure your furnace filters, located in the return air duct, are clean or newly installed before beginning.

4 Set your thermostat high enough to insure continuous operation of the unit throughout the test. Wait 15 to 30 minutes before you start.

5 Make sure the furnace "Operating" or "Limit" control is set correctly at 200 degrees F. The "Fan Control" should be set at 110 degrees On, 95 degrees Off. It is necessary for the fan to operate continuously throughout the test period. If your control has a "Continuous Operation Switch," turn it to "On" for the test period, but remember to reset it later.



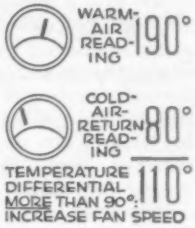
6 Using an awl or other sharp-pointed tool, puncture a small hole in both the warm-air ducts and cold-air return ducts big enough to insert a kitchen meat-roasting thermometer. Do not place the thermometer test holes in any elbow or where radiant heat from the furnace will affect the readings. The warm and cold ducts can be distinguished easily by feeling them if you're not sure which is which. After testing, you can seal the holes with sheet-metal screws.

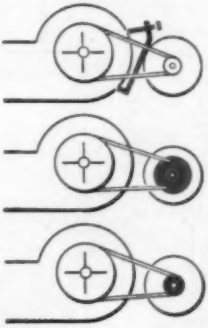


7 Insert the thermometer in the return-air duct, wait a few minutes, then write down the temperature reading.

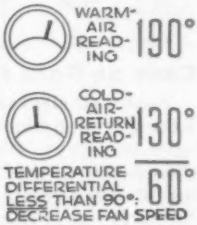
8 Insert the thermometer in the warm-air duct and record its temperature reading, too.

9 If the temperature difference between the two thermometer readings is *more* than about 90 degrees, the air volume should be increased by increasing the speed of the fan. Some warm-air furnaces have adjustable screws to control fan speed, while others have adjustable pulleys. Some units with fixed-size pulleys will need to be fitted with new pulleys to change speed. Consult your heating serviceman for advice on these.





10 If the temperature difference recorded between the two thermometer readings is *less* than about 90 degrees, the air volume should be decreased by slowing down the fan. In either case, make all speed changes with the current off, and work gradually until you see what the effect is. When the difference in duct temperatures equals 90 degrees, air circulation is at its proper rate for the best circulation of heat.

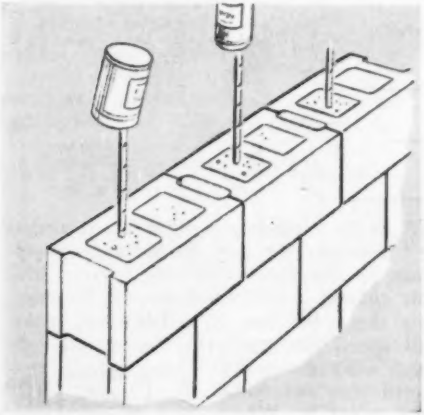


Short Cuts and Tips
FROM PS READERS

Hiding Joists with Removable Ceiling

UNCOVERED joists can be turned into a finished basement ceiling without permanently obscuring pipes and wiring. Inexpensive white-painted fiberboard panels, held by 1"-by-4" strips, do the trick. Trim the panels narrower than the joist spacing for easiest placing and removal.—*Don Walker, Moscow, Idaho.*

▶▶▶LOOSE wood screws can be anchored securely with cellulose tape. Remove the screw, wrap it with tape, and reinsert. Heat generated by turning the screw makes the tape act like glue and filler, too.—*John Mihalick, East Liverpool, Ohio.*



Cans on Rods for Safety

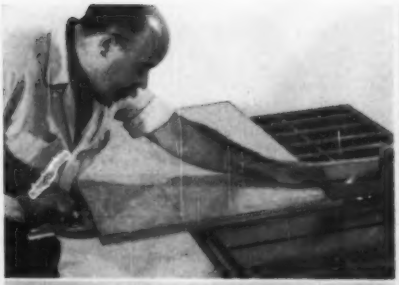
FLAGGING steel reinforcement rods projecting from a block wall will make them safer two ways. Tin-can covers make the rods easier to see, and offer some measure of protection should anyone fall on the rods.—*J. F. Butler, El Cajon, Cal.*

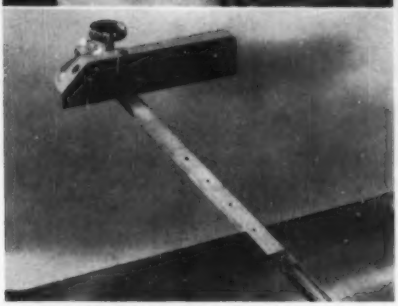
Steadying a Box Camera

BOX-CAMERA time exposures—and snapshots, too—can be improved with a tripod. The box camera may not have a tripod socket, but can be attached easily with a wide, heavy-duty rubber band.—*Walter Martin, Detroit.*

SHOP-USE REPORT on the New Atlas 10" Saw

by Herbert R. Pfister





MITER GAUGE IS KEYED to the table. When you're crosscutting wide boards, it can be drawn back to overhang the table a foot without dropping. The keyed slot shown just above retains guide bar on overhang, yet miter gauge can be lifted out of its slot when pushed to center of table.

YOU might think nothing more could be done to improve a tool as basic as a table saw. I thought so, too, until I ripped off the crate and began setting up Atlas' new 10" model. It's loaded with surprises.

After assembling the tool and mounting the motor, I looked for the usual

CONTINUED

instructions for adjusting the saw's alignment for accurate cutting. I found, instead, a check sheet signed by Atlas' factory tester No. 416. It illustrated the alignment checks he'd already made for me on the production line.

Tester No. 416 had used a straightedge and feeler gauge to see that the table was flat to within .015″. He'd proved with a dial indicator that the blade was parallel to the miter-gauge slots within .003″. He'd double-checked the fence to see that it was no more than .010″ off perpendicular to the saw table, and +.000″ —.015″ parallel to the miter-gauge slots. The miter gauge, too, had been tested at 90 degrees and 45 degrees to the blade with no more than .005″ tolerance allowed in accuracy at both settings.

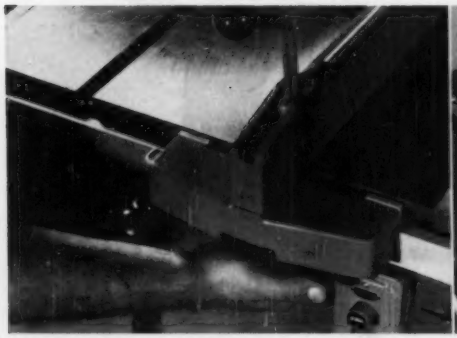
The first cut I made was effortless and true.

Putting the saw through its paces gave me the feeling that the people who designed it know how to use a saw, and have faced the same problems I've had when making certain cuts. They've added some ideas that overcome these problems and make the saw easier to use. Yet they've retained a number of features of earlier models. For example, the thick, sandcast aluminum fence still slides along its calibrated guide bar as easily as a lathe carriage gliding back and forth on the lathe ways. The big T head holds it in perfect alignment even while it's being moved. A rubber friction wheel has been added for fine adjustment.

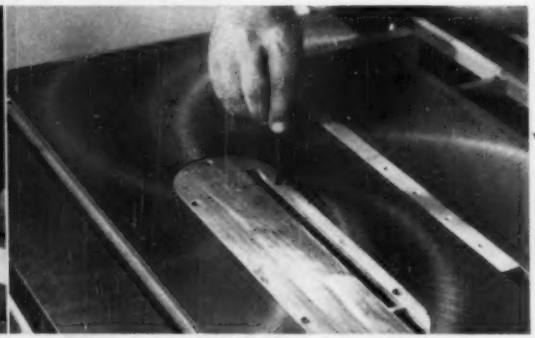
ALMOST FIVE FEET OF TABLE WIDTH, with the extensions in place, takes the awkwardness out of cutting off long boards. A plastic window on the guard lets you see the cutting line as the blade bites its way through it.

Crosscutting wide boards no longer requires luck and three hands. The broad-faced miter gauge is keyed to the slots in the table and doesn't drop when pulled back over the edge. It provides firm support even when overhanging the table as much as 12″ to start the cut in boards up to 25″ wide. As the miter gauge is pushed forward, the key helps it ride over the table's edge without binding.

Builders or craftsmen who like taking their tools to the job will appreciate the



FRICTION WHEEL ON FENCE permits fine adjustment to calibrations stamped on guide bar. Fence is a big aluminum casting with a T head that won't give way to side pressure when cutting. A single lever locks it at both ends by cam action. It can be lifted off table when not in use.



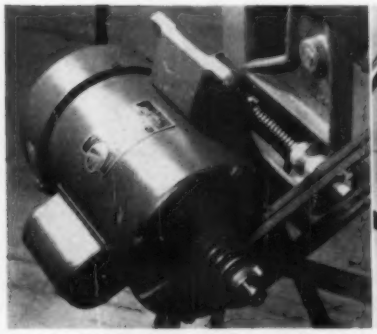
INSERT-PLATE ADJUSTMENT SCREWS are locked against vibration by nylon inserts in threads. Six recessed screws, adjusted from above, bring plate flush with table surface quickly. There's no need for trial-and-error settings as when screws are on the underside of the plate.

SIX PRECISION CHECKS illustrated here are made on each tool as it comes off production line. Alignment and accuracy are guaranteed and the saw is ready to use when it arrives.

motor mount. By loosening two screws and pulling a connecting plug in the cord running from the pushbutton switch, the motor can be removed quickly to permit the saw to pass through doorways. In two minutes, it can be back in place.

Big jobs are no burden to the saw. With table extensions in place on both sides, the 27½″-deep by 20″-wide table stretches to nearly 5′ in width. Dual V-belt drive transmits power from the one-horse motor to the blade, which is where you need it for heavy work. A big ¾″ arbor has one end turned to ⅝″ for mounting the blade.

Atlas sells the saw for $129.75, and I for one think it's worth every penny of it.

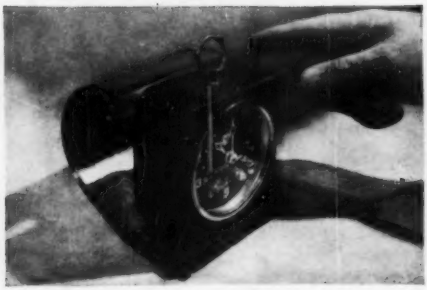


DUAL V BELTS prevent slippage under heavy cutting loads. A spring on the motor mount eases belt tension as the blade is lowered for light cuts. Longer belt life is the result.

PLUG-IN CONNECTION instantly separates motor from switch. Loosening two cap screws permits fast removal of motor and mount as a unit. Saw can then be moved through doorways.

PUSHBUTTON SAFETY SWITCH, mounted flush with the table edge, has start button enclosed in tubular guard. This prevents accidental turning on of machine if the switch is bumped.

Short Cuts and Tips
FROM PS READERS



Clock Ticks Time Prints

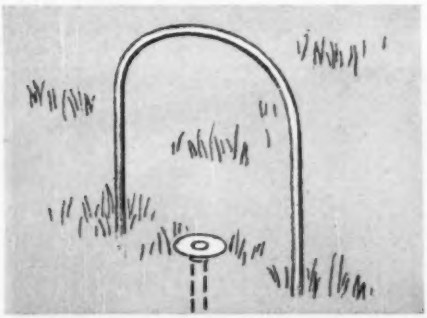
IF YOU don't have an automatic print timer, the ticking of an ordinary wind-up clock will help you count seconds just as accurately. A curved reflector bent from a tin can will make the clicks loud and clear.—*Ken Murray, Colon, Mich.*

▶▶▶I COULDN'T slip the hand grips off an old bike so I used a pipe wrench, turning them slowly as I pulled. I figured the grips would be ruined, but they came off easily and so unmarred that I was able to use them on another bike.—*E. W. Antonson, Duluth, Minn.*

Cool Water for Hot Shopwork

I TURNED our old refrigerator into an ice-water machine for my shop by winding 50′ of ½″ copper tubing around the ice-cube unit. I connected one end to an existing faucet and the other to a new one. —*Harry J. Miller, Sarasota, Fla.*

▶▶▶UNTANGLE kitchen power cords this way. Locate screw eyes near the end of the counter where the toaster and coffee pot are used. Pry the eyes open, insert the cords, and tape on small weights. The cords will automatically retract when not in use.—*E. L. Enochs, Modesto, Cal.*



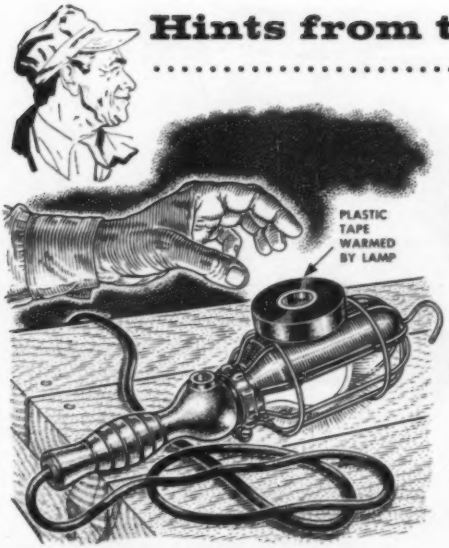
Permanent Markers for Croquet

YOU can quickly set up wickets for a game of croquet without measuring each time if you mark their locations. Old auto valve stems driven into the ground flush won't hamper mowing and will permanently indicate where each wicket goes.—*G. E. Hendrickson, Argyle, Wis.*

Swirl Rinse for Paint Rollers

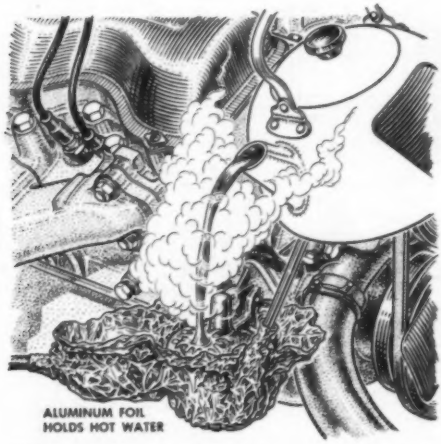
AFTER cleaning a paint roller, spin it with a stream of clear water shot at its edge from a garden hose. This throws out suds and paint particles, and raises the nap. Hang the roller by the handle to keep the nap from matting again.—*Douglas R. Smith, Miami, Fla.*

Hints from the Model Garage

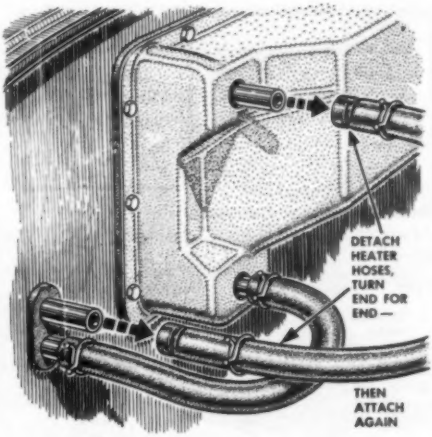


Plastic electrical tape must be warm and pliable to make it wrap and stick easily. When using the tape in cold weather, you can keep it workable by laying the roll on the shield of your trouble lamp, or on a warm engine.

Your car will start easier if you rock it back and forth with the transmission in gear. This causes the wheels to rotate the engine slightly—just enough to break the piston seizure caused by oil that congealed during the cold night.



Water frozen in the fuel-pump sediment bowl is almost impossible to thaw just by pouring hot water over it. To retain the water's heat long enough to have an effect, shape aluminum foil into a container around the frozen part and fill it.



Heater hoses deteriorate twice as fast at the ends attached to the engine because of the extreme heat and oil vapor. You can double their useful life by removing them and turning them end for end when they become slightly spongy.

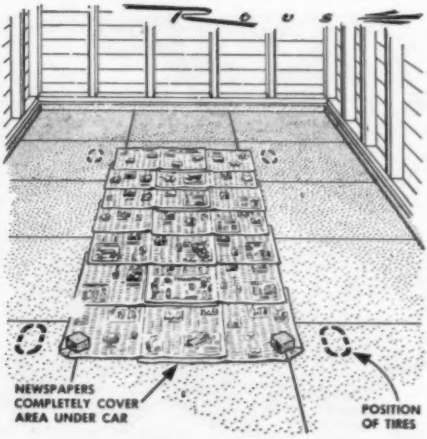
CONTINUED

More Hints from the Model Garage

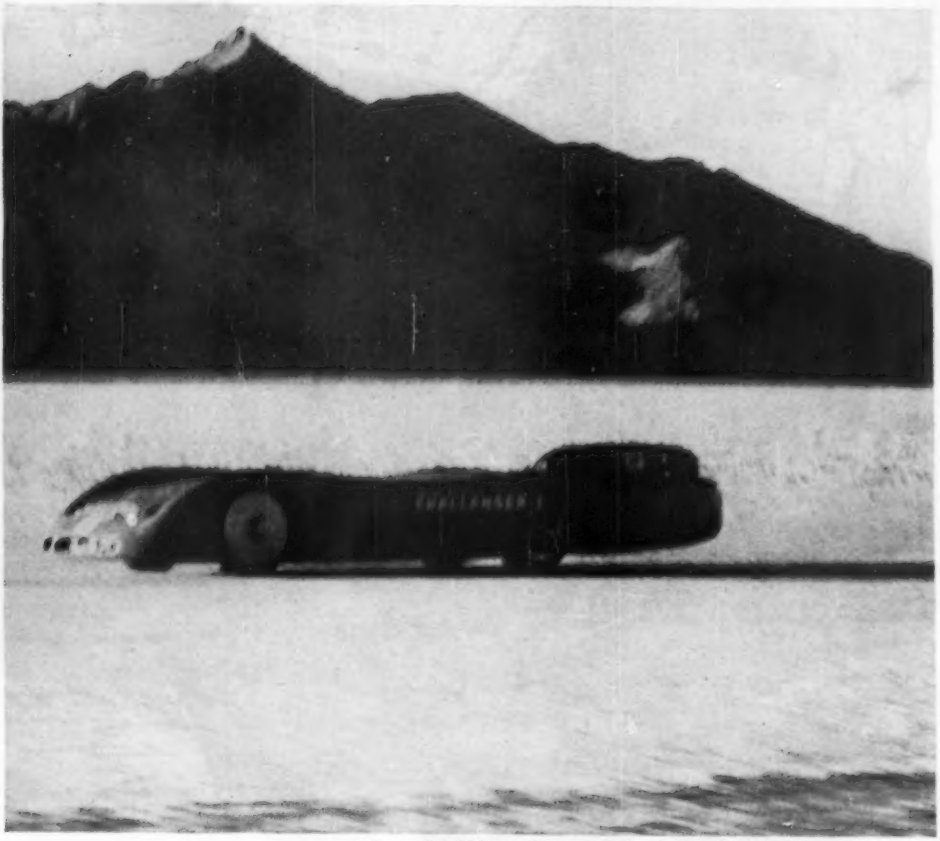
Weatherstrip that freezes to the door jamb after snow or sleet is often torn loose when you pull open the door. This won't happen if you clean the rubber when it is dry and coat it with brake fluid or rubber lubricant.

A stubborn wheel lug that resists brawn may yield to brains. Place the wrench firmly on the lug and rest the handle on the bumper jack. Operate the jack by pressing the ratchet lever with your foot until the lug loosens.

Small breaks in cork gaskets can be patched with a filler made by mixing grated cork with gasket compound. Grate the cork on the fine side of a vegetable grater and stir it into the compound until the mixture becomes stiff.



Newspapers can be placed accurately on the garage floor to catch every drop of oil dripping from the car if you mark the location of the four wheels. Since this seldom varies more than an inch or two, complete under-car coverage is easy.



363 m.p.h.! Mickey Thompson breaks the U.S. land speed record in his Challenger I, *powered by 4 Champion-sparked Pontiac engines!*

Q. Why does Mickey Thompson, holder of the U.S. speed record, use Champion spark plugs?

A. Men whose careers depend on *performance* and *power* know they can *rely* on Champions! Your car will get a boost in performance—and *save gasoline,* too—with new Champions. Put in a set every 10,000 miles!

World's favorite spark plug—engineered for every car built by Ford Motor Company, General Motors, Chrysler, American Motors, Studebaker-Packard and every major foreign maker.

CHAMPION

Before Hinchman could argue, one of the boys came running up. "Hey, Mr. Wilson, chow's on!"

Gus Thaws a

By Martin Bunn

A PAPER airplane, expertly launched from the rear of the bus, glided up the aisle and struck the windshield.

"Kids," muttered the sour-faced driver. "Every day, pick up a bunch of 'em and take 'em to school. Take 'em home again. And now on my day off, too."

"Boys will be boys, Frank," consoled Gus Wilson, who was sitting behind him. The Model Garage owner peered through a window at the snow-covered countryside. "Next turnoff to the right is ours."

He was answered by a grunt from the driver and a crescendo of falsetto "Yippees" from the youngsters who filled the yellow school bus. Doc Garvey, the dentist, had chartered it to treat the Boys Club to an overnight ice-fishing trip on Little River. Gus had come along because he liked fishing—and kids.

Frank Hinchman, the driver, and also owner of a fleet of school buses, didn't

Frozen Driver

like either. "Kids," he repeated in disgust as he double-clutched, jamming into a lower gear to wheel off the highway.

Gus stood up and zippered his jacket. "We're almost there, Frank. You'll soon be rid of us."

"Darn tootin' I will. I'm not crazy enough to spend the night in a sleeping bag this weather. Soon as the kids get all this gear unloaded I'm heading for a nice, cozy motel over at Centerville."

Doc Garvey assigned some of the parka-clad youngsters to gathering firewood, others to unloading tents and sleeping bags from the bus. Both chores were accompanied by boisterous, impromptu snowball fights. Gus went off to check the ice. Frank Hinchman stayed in the bus, scowling and reading a magazine.

As Gus came back up the river embankment to get a chain saw for cutting ice holes, he saw Hinchman ducking snowballs.

"You kids quit messing with my bus!"

CONTINUED

he shouted at the frolicking youngsters, shaking a fist angrily.

Gus intervened. "Okay, now, boys. Get along and set up camp like Doc told you." When they scampered off, he turned to Hinchman. "They're good kids, Frank. Join us for supper and you'll see."

"You kidding, Gus? Soon as they get the rest of the stuff out I'm on my way."

Gus saw that Hinchman was shivering. "Why not warm yourself at the campfire, Frank? There's a pot of coffee brewing."

"Don't mind if I do," said Hinchman.

THE shadows of the boy's windbreaks lengthened across the ice and the clear blue winter sky had taken on a tinge of red. Gus looked at his wrist watch.

"About time to knock off, Doc."

"My stomach agrees with you," said Doc. He held up a string of fish. "I can almost smell these sizzling in the pan."

"That's all for today, boys," Gus called out. "Get your tackle together and head for camp." He picked up his own gear. "Come on, Doc."

Keeping an eye on their charges, they trudged across the snow-covered ice and up the river bank. At the top, Gus nudged his friend. "Look, the bus is still there."

"About time you fellows came back." It was Hinchman, huddled close to a dying fire. "My bus won't start."

"What's wrong?" Gus asked.

"I'm no mechanic. Take a look at it."

Gus sighed. "Let's try starting her."

Hinchman climbed in and stepped on the starter. The engine caught, heaved, and died as if choked off.

"Sounds like fuel trouble," Gus said.

"Nonsense. I had this engine worked on yesterday—carburetor overhaul, new fuel pump." Hinchman's eyes narrowed. "Could it be ice in the gas line?"

"Could be," Gus said, "but I doubt it."

"I don't. It's those kids. You saw me chase them away. I'll bet they poured water in my gas tank."

"Look here, Frank," Gus said. "Those boys are having the time of their lives. I'm sure they don't know or care if you exist. Besides, cold as it is today, water would freeze before it reached the bottom of the filler tube."

"Have it your way," said Hinchman. "Just so you get me out of here."

"Got any tools?"

Hinchman reached over, opened a dash compartment, and looked in. "Adjustable wrench, pliers, and a screwdriver."

"They'll have to do," Gus said. "Now, if we're going to check the fuel, ask one of the boys to let you have an air-mattress inflating pump."

WHEN Hinchman returned, Gus had removed the gas line from the fuel-pump inlet. Wrapping a glove around the air-pump hose, he jammed it into the gas-tank filler. Then he went back to the engine.

"Okay, Frank," he called. "Pump."

Gasoline began to dribble, then throbbed from the disconnected line.

"Was I right—about the ice?"

"Nope. Line's clean. Come and hold a flashlight for me."

Hinchman watched anxiously as Gus reconnected the line and unhooked the other side of the fuel pump. He grounded the solenoid to run the starter. Gas gushed in even pulses from the outlet.

"Looks like carburetor trouble, unless the line is clogged between the pump and the carburetor."

"Can you fix it?"

"I'll try, when I warm up my hands." Gus stuck them into his jacket pockets.

Hinchman kicked a tire. "Darn that relief driver. He should have had this job, only his wife's having a baby." He kicked the tire again. "More kids!"

Gus felt like kicking Hinchman. Instead he got back to work. Finding the

Where'd it come from?

Pockets: Those useful catch-alls once meant a specific quantity of wool—half-a-bagful, or about 182 pounds. As pockets gradually were adopted for transporting general merchandise they shrank in size. It was a short step from that to being hand-carried or belt-attached, and eventually they were sewn right into clothing.

CONTINUED

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Rochester-GM Carburetor specialists have scientific Kleanout kits on hand that enable them to give you a quick on-the-car carburetor clean-out, or an off-the-car carburetor clean-out with Off Kar kits. Each has factory-recommended components to do a thoroughly satisfactory job for you. Should your carburetor need overhaul, these same specialists have just the answer; Rochester-GM Carburetor Master kits. All the right parts for a top-quality job insure your getting your carburetor back into the new car condition you want.

BT-3 Balanced Tune-up is the new thorough-going method of checking and adjusting to restore compression, ignition and carburetion to new car performance standards. This GM-approved procedure brings back the satisfying, smooth flow of power you want from your car. Remember—it's a three-way improvement—and you need all three: tight compression, snappy ignition, top carburetion. Ask your Rochester-GM Carburetor specialist to put your engine back in the top performance and economy bracket.

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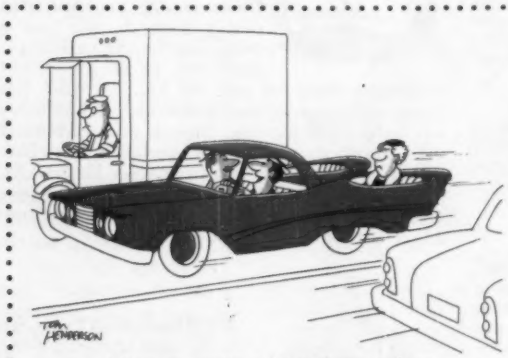
ROCHESTER CARBURETORS

wrench flats on the flexible fuel line rounded off at the carburetor end, he wrenched on the carburetor inlet fitting itself. With his lips to the line, he blew back into it. No obstruction.

Then Gus had a hunch. "Let me have the flashlight." Moving into a position so Hinchman couldn't see, he groped into the open carburetor inlet hole with the screwdriver.

"Afraid it's carburetor trouble, Frank," he said, straightening up. "No job to tackle tonight."

BEFORE Hinchman could argue the point, one of the boys came running. "Hey, Mr. Wilson! Doc says to tell you chow's on. We're having fried fish, skillet bread, and potatoes baked in the coals."



"Cost me quite a bit to have it done, but I felt my mother-in-law was worth it."

"How about it, Frank? Sounds mighty good to me."

"Got to eat, I guess," Hinchman said grudgingly.

Half an hour later the boys were gathered around the campfire singing "Old MacDonald Had a Farm."

Gus filled a pipe and struck a match. "Had enough to eat, Frank?"

"I can hardly move," Hinchman said. "Must admit I don't remember when food tasted so good." He yawned. "Did those boys really cook everything, Doc?"

"Yep, right from cleaning the fish."

"Wonder how cold it is."

"Last time I looked at the thermometer it was 18 degrees," Doc said.

Gus got up. "Here's an extra sleeping bag, Frank. Might as well crawl in and keep warm—only until you're ready to bed down in the bus, of course."

It wasn't long before Hinchman was snoring. "Better zip him up," Doc said. "It's time we all hit the sack."

HINCHMAN woke up fighting the confinement of his sleeping bag. He sat up, shielding his eyes from the early-morning sun. Gus came over, warming his hands on a steaming cup of coffee.

"Hey, Gus. What am I doing here? I'm supposed to be in the bus."

"Doc and I weren't going to carry you there, Frank."

"Guess I fell asleep," Hinchman said sheepishly. His nose twiched. "Say, what's that smell?"

"Bacon and eggs, hot cakes and coffee, Mr. Hinchman," said one of the boys.

Gus watched the bus owner shovel in the food, talking to the boys between mouthfuls. Frank Hinchman was smiling.

"I don't believe it," Doc Garvey said. "I even think I heard the old cuss laugh."

"Glad he's in a good mood," Gus said, "because I'm going to have to tell him I fixed his school bus last night."

"You did what?"

Gus dug a tiny tube-shaped brass screen out of his pocket. One end was open. The other had a recessed brass cup.

"The open end of this filter screen should have been pushed over a shoulder on the end of the carburetor fuel-inlet fitting," Gus explained. "When I removed the fitting, the screen didn't come out with it. I fished it out."

"Was that the fix?" Doc asked. "You could have started the car then?"

Gus nodded. "There's a little spring to hold the filter screen over the end of the fitting. Someone who worked on Frank's bus forgot to put it in. The screen worked itself off the end and surges of gas forced the capped end up against the inlet hole, cutting off the fuel supply. When the float chamber emptied, the engine quit."

Doc grinned. "Gus the Good Samaritan. What if it had turned out to be a frozen line?"

"That would have been easy, Doc. The big problem was thawing out the driver."

PONTIAC'S TEMPEST ENGINES ARE FULL-HOUSE

Pontiac for nineteen-sixty is a mighty full package for those with a highly trained sense of car appreciation.

Lovers of true road machinery have been having a field day admiring the great new Tempest power plants. Ranging from the economy 215 horsepower model to the full-house 318 horsepower version, they're the most respected V-8's ever tucked under a passenger car hood. Gear boxes to match. Axle ratios to suit.

And listen. The noise boys have dampered sound down to where you'll swear they've insulated the *road*. Suspension improvements have also helped in this department . . . as well as in ride and handling.

These are the kinds of advances you expect from the team that created Wide-Track Wheel Design—greatest cure for "car-sickness" in an American passenger car. 'Nuff said? Go see! You'll learn in a quarter mile why people who know cars *best* respect Pontiac *most*.

PONTIAC MOTOR DIVISION • GENERAL MOTORS CORPORATION

PONTIAC THE ONLY CAR WITH WIDE-TRACK WHEELS

MOTOR LIFTS OUT of the mower shell (left) after simple disconnect. The 2½-hp. engine maintains 3,600-r.p.m. speed within 300 r.p.m. by means of a sensitive mechanical governor said to be unique on gasoline mower motors.

MOTOR DROPS DOWN into outboard assembly. Coupling on the motor shaft fits over the end of outboard's splined propeller shaft. Three bolts secure engine in place. Complete outboard weighs 43 lb.

One Motor Powers Mower and Outboard

WITH a new, three-unit combination you can cut the lawn or propel a small boat. The power unit is a 2½-hp., one cylinder, four-cycle gasoline engine. It fits into a rotary-mower shell or into an outboard-motor assembly.

Switching from mower to outboard use takes a screwdriver, a wrench, and a Woodruff key supplied with the unit. The throttle cable, cutting blade, muffler, and three mounting bolts are removed. This frees the engine, which is lifted out of the mower shell. A cooling fan and an engine-shaft coupling are then attached to the power unit. Lowered into the outboard assembly, the engine shaft is coupled to the propeller drive shaft. The three engine-mounting bolts are tightened. Bolting a heat exchanger to the exhaust finishes the conversion.

Acco Power Products of Exeter, Pa., sells the Outboard Mower for $149.95.

YOU START THE OUTBOARD by cranking the impulse starter handle on top of the motor. The seagoing rig is 43 inches high and has a seven-inch-diameter prop that turns at 2,400 r.p.m.

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Compartmented Case Includes...

Spark Lighter | Pencil Burner and Valve | Two Cylinders of Fuel | Brass Utility Burner | Brass Flame Spreader | Brass Soldering Attachment

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- Lighting Fireplace
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- Starting Incinerator
- Sweating Copper Fittings
- Removing Putty
- Thawing Frozen Pipes
- Loosening Frozen Nuts

You'll find so many uses for your Craftsman Propane Torch this winter, you'll wonder how you ever got along without it. Chores and repairs that were too hard to do before now become easy! The Craftsman Propane Torch is as simple to light as a gas stove—no filling, no pumping, no priming. Safe, too, it lights or burns in any position—even upside down! (UL listed.) Carry the kit to your work—accessories are always with the torch, handy and in place. Get this Craftsman kit now and save $5 during Sears January Special!

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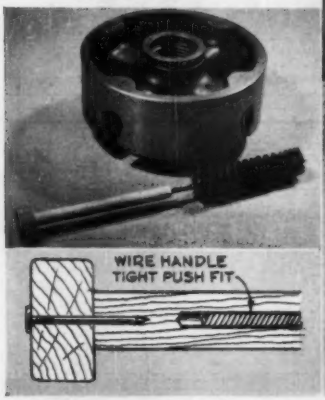
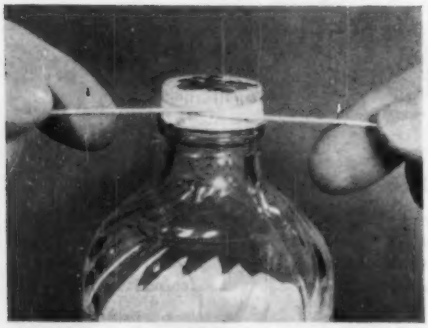
Short Cuts and Tips
FROM PS READERS



Chuck-Cleaner Made from Bottle Brush and Dowels

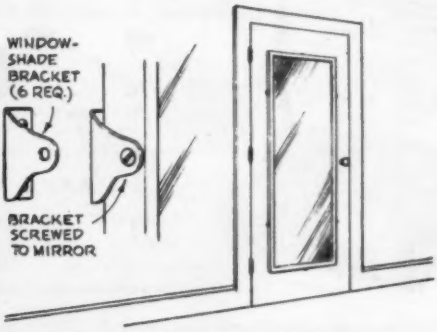
BEFORE mounting a chuck on a lathe spindle, you should brush chips out of the threads of both spindle and chuck.

Any brush will do for the spindle. A bottle brush is good in the chuck, but it should have a handle that rotates easily. You can make the handle from a 4" piece of 3/8" hardwood dowel and a 1/2" button of 2" dowel. Drill the dowel to take the wire of the brush and fasten the button with a single nail. Hold the button against the palm with your third finger and rotate the handle with thumb and index finger. —*Walter E. Burton, Akron, Ohio.*



Loosening Bottle Caps

WHEN the metal screw cap on a bottle is so tight you can't budge it, try this: Turn a heavy string once around the cap and, holding an end in each hand, see-saw it back and forth a few times. You can hold the bottle beween your knees while doing it. The heat generated by friction often expands the cap enough for it to turn easily.—*Ken Murray, Colon, Mich.*



Hanging a Full-Length Mirror

YOU can mount a full-length mirror on a bedroom door or wall with six dime-store window-shade brackets. Holding the mirror in the desired position, mark the edges on the door. Screw on the brackets with the tabs in so they will be concealed. Then place the mirror between them and screw to the frame through the roller holes.—*R. M. Woodbury, Natick, Mass.*

Fastest moving Sea-Horse ever launched

JOHNSON V-75

...combines new speed, power and dependability in 1960's "dream" motor!

The 1950's were exciting years in outboarding! Ten years ago who could have imagined the progress that has been made in outboard power, speed and dependability?

An all-new motor for a new decade

But what lies ahead for the 1960's? Johnson engineers have come up with their answer—the all-new Sea-Horse V-75, a "dream" of a motor. For the first time in outboard history you can get the best of speed, power, quietness and dependability in a single power plant.

A new high in "V" power

Johnson's famed, balanced-firing V-engine design now develops a full 75 hp, O.B.C. certified at an easy running 4500 r.p.m. Displacement is 89.5 cu. in. This fast-thrusting power makes heavy cruisers feel frisky as runabouts!

New speeds of over 40 m.p.h.

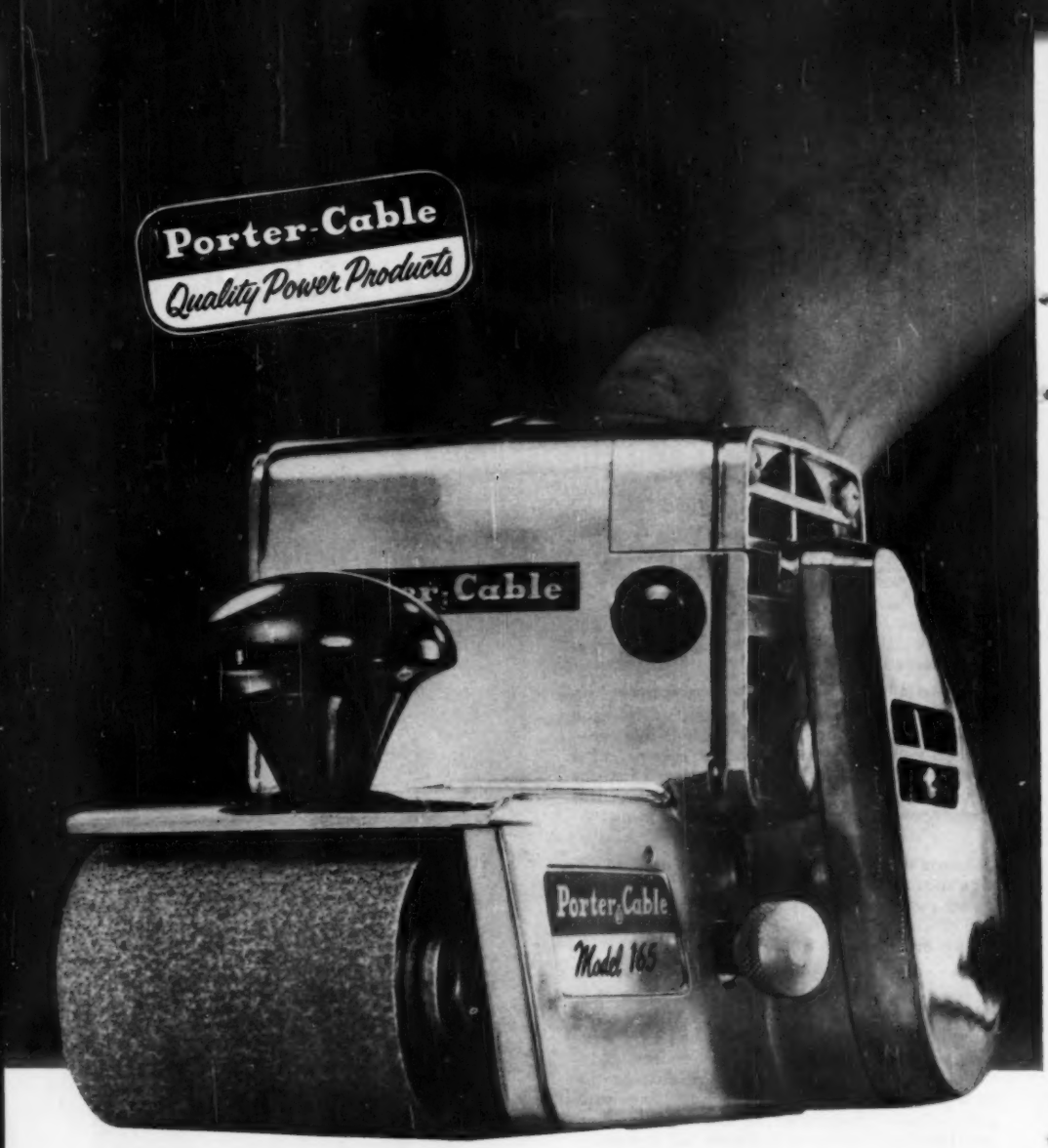
Actual on-the-water tests have verified that this is the fastest moving Sea-Horse ever launched. One reason: the V-75 has a remarkably compact, yet complete, lower unit gearcase. The lower unit is *blade-thin*, cutting the water with far less drag than any lower unit ever before—an engineering masterpiece when you consider that it still allows *full* gearshift. You also get a choice of 3 propellers, at no extra cost, to get maximum performance whatever your boat or load.

New ideas in dependability

Over two million Sea-Horses already built (more than any other make) have earned the reputation of being the most dependable outboards afloat. But Johnson engineers were not satisfied. For 1960 the V-75 has outboarding's first automatic choke for faster starting in any weather. They have added new hydraulic shock absorbers to absorb the shock of the motor when it flips up and comes down, should you hit an underwater obstacle at high speed.

New Sea-Horse V-75...$895 with electric starting

See this exciting V-75 and six other new Sea-Horses, 3 to 40 hp, now at your Johnson dealer's. He's listed in the Yellow Pages under "Outboard Motors."



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We Nearly Had Pigeon-Guided Missiles
[*Continued from page 73*]

creditable 55 percent of their 96 "runs" on the distant ship (a quarter-inch-long image on the screen) were judged successful. Four pigeons, star pupils, averaged 79 percent. With the near ship, the score for all improved to 60 percent, despite erratic steering. (Pecks landed all over the screen-filling image.)

Observers called the pigeons' pecking rapid enough to steer a 600-m.p.h. missile. That was the speed of the Navy's jet-propelled, ship-launched Regulus I missile, just developed in 1948.

Color movies came next. Sent up to get them, a jet plane made diving runs on a destroyer and a freighter. The destroyer film tested whether a ship's rapidly enlarging image, as a missile dived on it, would confuse the birds. It didn't—60 percent of their runs succeeded. The four star performers scored 80 percent.

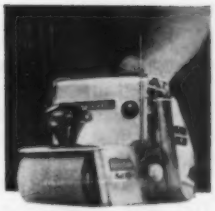
Approaching a ship from different angles—ahead, astern, broadside—did throw them off. Their score slumped to 30 percent; the Elite Four's to 40 percent. But switching the target from a destroyer to a freighter, a bigger change to human eyes, didn't bother them at all.

By now, Project Orcon was nearly three years old. Other guidance systems, with increasingly sophisticated electronics, were vastly improving meanwhile. It was time to compare merits.

Pigeons had shown they could guide missiles—well enough, under ideal conditions, to score hits. But clouds, waves, and shadows could mislead them. Pigeon piloting was restricted to visual range. It would work only in daytime.

Rival systems' attractions prevailed. Project Orcon coasted to an end in 1953. After keeping it under wraps six years longer, the Navy decided the extraordinary story could be safely told.

The tale has a footnote. Today, the conducting glass developed for the Secondary Trainer's screen has become a key feature of U. S. warships' combat information centers. It serves in radar displays on which plotters trace the course of attacking aircraft with electrical probes. So Project Orcon did make a valued contribution to defense, even though a pigeon never rode a missile.—*Alden P. Armagnac.*



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The Corvair Coast-to-Coast

[Continued from page 115]

"What's that funny sound?" I asked my wife, uneasily, on a rainy morning.

She listened. "Oh, that," she said. "That's just the tires going through the puddles."

Some of our driving days got warmish, and here we experienced another unexpected satisfaction. No engine heat drifted back to us from up front, no transmission heat from the floor.

At our nightly stops I had the chance to mull over other characteristics of the car. The headlights, for one thing, were nothing less than splendid. On high beam, they picked up reflective signs a mile away.

Despite a heavy luggage load on the rear seat, the car had none of the rear-end sag and the headlight deflection that afflicts most automobiles.

Steering was quick and light. That, and the car's dimensions, made parking a snap. Despite a weight distribution of 60 percent on the rear wheels and 40 on the front ones (compared with 45-55 on conventional cars), I found no oversteer. That is the tendency of an automobile, particularly those with rear engines, to tighten a turn. Nor did I find that companion of oversteer—excessive wind-wander and wheel fight at high speed in high winds. My wife did not agree with me entirely.

With a 3.55:1 axle, the car's power was—to me—no more than adequate for passing on two-lane highways at speeds of 60 m.p.h. and above. I was inclined to wait longer, for clearer going, than I would have with a more muscular engine.

As with any automobile, the Corvair can be subjected to niggling criticism.

Spark timing was a problem. For maximum power in the mountains, I had the spark advanced. At the same setting (five degrees before top dead center) on the Southern California coastal plain, I got annoying engine ping. This was due to the denser air charge (automatically increasing the effective compression) and, perhaps, the tendency of all air-cooled engines to run hotter than water-cooled ones. No doubt the lower octane rating of Western fuels contributed, too.

Some ping in the Corvair under heavy load is perhaps inevitable.

The aluminum engine's low inertia requires a practiced touch on the accelerator to keep from killing it when releasing the clutch in low gear.

I had been told that dripping oil on that snaking fan belt could lead to its early deterioration. So I grew old-maidishly fussy about handling the dipstick and replenishing the oil myself.

The tire pressures are critical for ride and handling. I felt impelled each morning, in 17 days of pretty hard driving, to recheck the specified 15 pounds in front and 26 rear (cold).

The top of the panel was gloss-finished, and with the sun at a certain height, driving into it created a blinding hot spot in the windshield by reflection.

I found that the spare tire's pressure couldn't be checked without unscrewing the locking wing nut and pulling the wheel toward me. That's because the valve faces away from you.

My second thoughts on the stamina of the V-belt cooling system occurred at the factory, in Willow Run, Mich., where I stopped on my way home. There I was told that belt breakage had been occurring when the belts were tensioned at more than 100 pounds on the production line. The requirement was 80 pounds—read at the moment of deflection on a simple spring scale. In the first few days of production, evidently someone hadn't been given the word.

That squared with my experience. At Albuquerque, N. M., the belt had begun riding on its side over the idler pulley. It was too tight. A mechanic reduced the tension, but the damage already had been done. The belt failed in the next 375 miles. The replacement belt, properly tensioned, performed perfectly from there on.

Finally, that heavy rear end must be treated with respect. On the shores of Lake Michigan, I insisted on taking a picture of the POPULAR SCIENCE Corvair against an eye-catching background of breaking waves.

"Better not get into that sand," cautioned my wife.

"You stay in the kitchen," I told her. "I'll handle this."

It was a half-hour before a Good Samaritan came along to tow me out.

I still love the Corvair.

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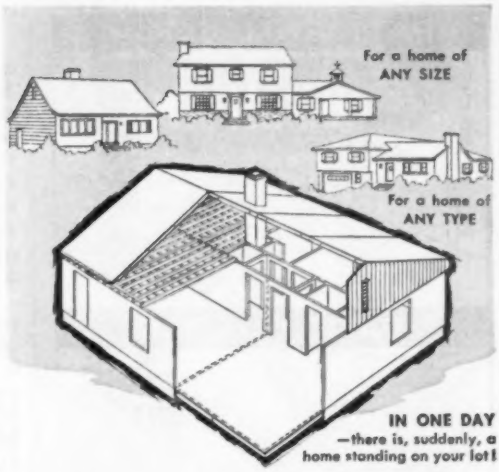

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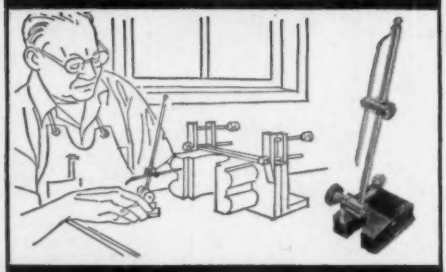

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The Corvair in Rough Going
[*Continued from page 118*]

ocation, when we were descending the Mt. Washington Stage Road. (Shut for the season, it was opened as a courtesy to PS; and, since the road was icy and the weather atrocious, the management kept a fatherly eye on us by phone and radio.) We were coming down fast on a series of switchbacks. The surface was deeply corrugated, frozen, lubricated by a thin glaze of slush.

A rational speed on this slithery, 14-percent downgrade might have been 10 m.p.h. For experiment, we pushed it to 20, 25, and then 30 m.p.h. Still on rails. It wasn't until we tried the mountain turns at about 35 that she came all loose in some quick and hairy tailwags. Simultaneously we realized that the scenery nearby—granite, arranged vertically—was the sort that could wrinkle more than a fender. So we hastily backed off, and liked the Corvair even more.

That crazy heater. The designer of an air-cooled car can bleed heated air from the engine, run it through an exchanger, and, with considerable ductwork, breathe warmly on the customers. Or he can simply drop in a separate gas-fired job. The Corvair people chose the latter. They supply an awesome and whimsical piece of machinery, laden with blowers, firepots, tubing, hoses, and assorted bits of fail-safe gadgetry. It is said to drink .1 gal. per hour in normal use, and .25 gal./hr. in bitterest weather.

We ran it continuously, preferring comfort to the m.p.g. that it cost us. It worked fine once we got the hang of its controls (no ram air, a two-speed blower, and a very sensitive thermostat). On bleak early-morning starts it was a joy, for it began to spit out therms only 18 seconds after fire-up.

One whimsical aspect was an ingenious "purge circuit" that makes the combustion blower run for a measured interval after you shut it down. This leads, the first time you put the car away for the night, to a momentary sense of despair at your inability to turn things off. Another oddity is the bizarre noise it sometimes makes—burbles, growls, thrumbles, a high canary trill, and occasional flatulent burps. None of these antic sounds are audible at road speeds. But in town, idling at a red light, you have the im-

pulse to say "Beg pardon" to passing pedestrians.

Blow, ye crosswinds. On a bleak 100-mile stretch along the St. Lawrence we had strong, gusty crosswinds. We found them something between a problem and a nuisance. It was certainly easier for us than for a poor VW we tailed briefly; he was all over the road. But the Corvair plainly knew that the wind was blowing. Careful observation suggested that the car was not directionally sensitive to gusts: They did not set it on a new, tangential course. Instead, a sharp gust simply displaced the car a few inches sideways, on roughly the same course.

Power plant. The little 140-inch aluminum mill starts immediately and warms up fast. Hills are no problem; passing at low speeds is done a little more circumspectly than usual, because the engine has relatively little muscle at the low end. Above 45, she accelerates handily.

One odd bit of engine trouble plagued us for a time: a perplexing roughness and output loss that occurred only at high speed. No ordinary tune-up procedure helped it. It was finally found to be high-speed carburetor icing, occurring in cold, wet weather. Chevy engineers confirmed the diagnosis, and added that a running and retroactive fix had been added to all cars. This bleeds a little warm air from beneath the shroud to raise inlet air temperature slightly.

The squawk sheet. In heavy rain we took water around the driver's door and in the luggage compartment. The headlight dip switch was temperamental. The parking brake, which is set by a ratcheting arm and released by a separate lever, couldn't be undone except with a resounding crash. There wasn't quite enough leg room for a tall driver. The dash panel needs redesign: On the left it casts instrument-light reflections on the windshield, and on the right it faces the passenger with a murderously hard, sharp edge. The stick shift, otherwise a pleasure, had too long a throw. Door locks (they're set by reverse travel of the inside lever) can't be checked visually; you have to try each door.

In summary. On rough going, Corvair is both capable and delightful to drive. Its six-inch ground clearance and decisive traction help it go in mud and snow.

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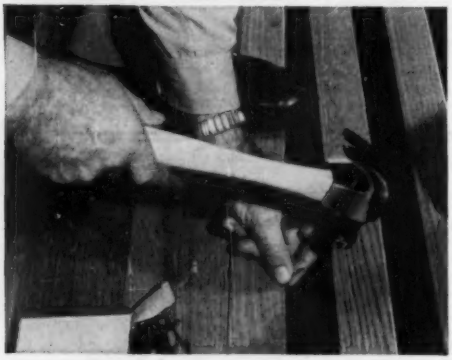

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[Continued from page 133]

adjusting brakes are new for Lincoln this year.

- Rambler. All models have switched from riveted to bonded linings for longer lining life.
- Studebaker. Finned, weather-sealed brake drums are standard on all Hawks this year.

OCTANE appetites are less finicky for most of the 1960 engines. The average octane number needed to satisfy the new cars is down slightly for the second year in a row. A long steady climb in octane requirements that saw the average rise from around 70 in 1947 to 96 in 1958 has definitely leveled off. Engine engineers say it is likely to remain near the present level for the foreseeable future.

In part, this reflects an increase in the number of models that will run on regular gas. But even on engines for which there has been no change in the grade of fuel recommended, octane requirements have been reduced to give a greater margin of knock-free operation. This has been achieved by minor reductions in compression ratios, juggling spark-advance curves, and in some cases by changes in combustion-chamber shapes. It was brought on by persistent complaints from customers living in areas where the octane ratings of pump fuels fall below the national average.

Another problem that has plagued late-model cars is foreign particles (mainly iron oxide) in the gasoline. Auto makers have made an all-out effort to beat the specks this year. Just about every car has a new fuel-filtering system. Most are using a new throw-away filter element in the fuel line and a plastic filter in the gas tank.

Cuts in horsepower are common. All but the plushiest makes have "economy" engines available. Two-barrel carburetors are more widely used. Mercury and Lincoln, in fact, have abandoned four-barrel carburetors completely.

Several other makes have switched from four- to two-barrel jobs for their standard engines. Chevrolet has dropped its optional fuel-injection engine for passenger cars. It is available now only for the Corvette.

Driving the Air Scooter

[Continued from page 135]

Now the fun began. I shifted my 180 pounds to the right. The scooter tilted that way and, with an eerie will of her own, seemed to slide downhill like wet Jell-O on a plate. We sailed along at about 10 m.p.h., pushed by the wind. Unnervingly, the scooter revolved in 20- to 30-degree swings.

We drifted 50 feet along the hangar apron, right to the edge. I wanted to stay off the wet grass so I leaned to the left. But the scooter just hung there. Maybe the wind was giving me trouble; maybe it was natural malevolence. The handlebars, connected to nothing, were no help except as handgrips. I leaned forward. She promptly dipped and stuck her nose on the ground. Oops, too much. I leaned back to level her up. Gently, gently now —just a touch of forward weight. That did it. The scooter moved ahead.

Gradually I circled her back to the starting place. The course was zigzag. I rolled back the throttle. Engine noise dropped. Softly, as though landing on a mattress, the scooter sat down. I relaxed for the first time in 10 minutes and grinned like an idiot.

I've put a lot of time in on motorcycles, scooters, boats—everything that leans. But this oddly cranky air scooter was by far the most sensitive. Its handlebars do nothing. The throttle only puts you up or down. The crucial parts of control, direction and speed, are managed by lean alone. At the present state of the art, it is not remotely a highway vehicle.

But perhaps a yogi would feel at home on the air scooter. Any man who could shift his stomach a few centimeters left or right might have it made. Trying to be moderate at controlling, I had found myself staring at obstacles much like a yogi when we sidled up to them. By a powerful act of will I had hoped to make the machine back off, but the scooter never got the message. It kept banging into the wall or whatever until the correct, infinitesimal twitch sent it gliding away.

I had done quite well for the first time, Sweeney told me. All I needed was another half-hour in the saddle to match Princeton's best riders. I beamed. Of course, he added, of the hundred or so who have flown the air scooter so far, only one has failed to make it perform.

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Machine Parts Too Small to See

[*Continued from page 69*]

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Gilbert gazed at one of the shining specks on his desk and remarked, "We can make them half that size if anyone needs them."

Success story. Another builder of mighty pygmies is 31-year-old Edward A. White of Fort Wayne, Ind. The son of a Boston electrician, at 15 he got a job in a Harvard electronics research laboratory to finance his engineering studies at Tufts, and later helped to teach a Harvard computer how to multiply. Eight years ago he saw the need for miniature gears, and set to work alone in a Fort Wayne two-car garage with a single gear-cutting machine and an instruction manual.

Within five years his annual sales topped $1,000,000. Today, as president and chief owner of the Bowmar Instrument Corporation, he is the country's leading manufacturer of gear wheels so minuscule that they can get lost in pocket lint.

White owes much of his success to the development of the "servo-mechanism"—a compact electro-mechanical "nerve bundle" that aims guns, tunes airborne radar antennae, guides missiles, and does many other control jobs. This little triumph of automation needs a nest of intermeshing gears to adapt the speed of its flea-power electric motor to the control device, and superprecise midget gears were hard to find.

White supplied the missing link. Today, his gear assemblies are used in the newest jet bombers, the X-15 rocket plane, the Jupiter, the Redstone and many other missiles.

Smaller and smaller. In a tour of his new plant, manned by 300 employees, Mr. White pointed to a little cylinder the diameter of a penny and less than two inches long. "That contains a complete electric motor and gear transmission used in airborne radar and other advanced guidance systems," he said. "It has been sweated down from a device three times

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White's smallest gears weigh about a thirtieth of an ounce and have teeth no larger than a grain of sugar. Too small for the human eye to inspect, they are magnified by an optical instrument and blown up on a screen. When White entered the business, a gear tooth that had a tolerance of one-thousandth of an inch was considered highly accurate; his gears are 10 times that accurate.

The little motors that operate these guidance devices are another marvel of micro-miniaturization. One of the world's smallest, made by the Eclipse-Pioneer Division of the Bendix Aviation Corporation, is about as thick as a fountain-pen barrel and about an inch and a third long.

Demand for accuracy. Hand in hand with size-shrinking goes a constantly increasing demand for dimensional accuracies once undreamed of. Says Louis F. Polk, Bendix vice-president: "Projected piloted plane speeds of more than 4,500 miles an hour and missile altitudes up to 240,000 miles with speeds of more than 24,000 miles an hour present incredible precision requirements in making control systems and various sensing devices. Within 10 years the components of these devices will probably have to be accurate to a tenth of a millionth of an inch." That is, an imprecision too infinitesimal for the human mind to comprehend, or a speck of contamination too minute for human perception, could be magnified into gross errors of navigation when tomorrow's space monsters blast off into the unknown.

Shrinking such devices without sacrificing reliability is fabulously expensive and time-consuming. It has taken International Business Machines three years and two million dollars to reduce the weight of a certain missile-guidance system from 100 to 25 pounds, and IBM expects to spend an equal sum getting it down to two or three pounds.

New lows in size-shrinking are reported whenever engineers meet. A lightbulb the size of a pinhead has been fabricated by the Army's Diamond Ordnance Fuze Laboratories for use in computers. It may also be placed on the ends of dial needles in airplanes.

Radio "dice." Within a few months,

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Texas Instruments, Inc., has produced a bit of metal, about the size of a kitchen matchhead, that will do the work of a dozen electronic devices. General Electric Co. recently demonstrated its new compact "tunnel diode" in a complete FM transmitter that will slip into a vest pocket.

What of the future? Years ago Dr. Vannevar Bush, former head of the Office of Scientific Research and Development, conceived of a marvelous electronic gadget no bigger than a desk that would record or photograph all the memorable facts and fancies of a man's lifetime—business records, mathematical formulas, bits of verse, conversations, baseball averages, addresses, Christmas lists, opinions, speculations. At the push of a button, desired information and all its associations could be flashed on a screen. After a few weeks spent among the micro-miniaturizers, it seems entirely possible to me that Dr. Bush's "dream desk" may some day come true.

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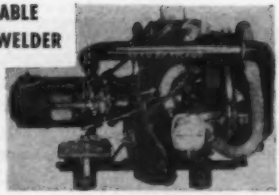

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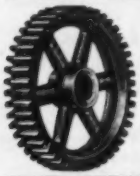

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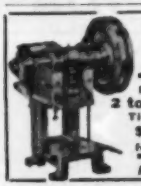

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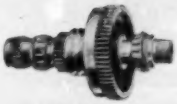

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Can "Loony Gas" Win Wars?

[*Continued from page 87*]

other casualties. With gas the same results would have been obtained, but American casualties would have been avoided. If the new incapacitating agents had been available, it is conceivable that neither side would have lost any appreciable number of men."

Psychochemicals promise "a relatively cheap and rapid means of fighting limited war, which has come to the forefront in the last few years," Gen. Stubbs observes.

Better yet, he and others suggest, they offer hope of deterring hostilities. Their velvet-glove nature would suit them to bold action short of fighting—like moving in at a trouble spot—to stop a cold-war crisis from exploding into a shooting war.

Saboteurs, in contrast, could work havoc with psychochemicals. Reports the House committee: "They suggest covert uses . . . to confuse defense or retaliatory forces . . . to affect the rationality of important leadership groups at some particularly crucial point in history . . . In a command center, psychochemicals would be disastrous."

A loony-gas sprayer could be concealed in as innocent-looking a vehicle as a laundry truck, suggests Gen. Creasy, who spells out the possibilities:

"Suppose there is going to be a heavy bomber or missile attack on the U. S. At the appropriate time, would it not be rather simple with, say, 35 or 40 trucks to circle all our Nike bases in the country?" Or Air Force stations, or the Pentagon, he adds.

Imagine a radar-screen watcher lost in rapt contemplation of "little live turtles"—actually the luminous blips of oncoming ICBMs—and you have something to shudder about.

Is there any defense? "A gas mask would be effective," says Dr. Bernard P. MacNamara, Army Chemical Center toxicologist. "However, I doubt that anyone would know when to put the mask on." Some psychochemicals (including LSD) are odorless, as well as invisible.

How quickly do they take effect? Dogs succumbed in about one minute to a paralyzing agent that left them limp and unable to move. In the cat-and-mouse experiment the drug took effect in about 10 minutes.

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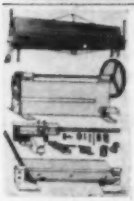

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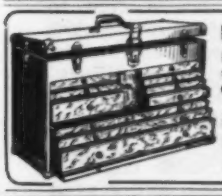

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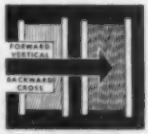

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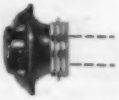

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Can "Loony Gas" Win Wars?

LSD takes 20 to 60 minutes to affect people at all, and its full effect begins in the second hour, according to the medical reports. Obviously military operations would have to be timed to coincide with the period when people are under the influence of the psychochemical used.

What is loony gas made of? Raw materials for loony-gas concoctions suggest the ingredients of a witch doctor's brews.

Dark-purple grains of ergot, a fungus parasite of rye, yield the loony gas LSD and others of the lysergic-acid family. Ergot has long been the source of potent medicinal drugs, used to stop hemorrhaging after childbirth and to treat high blood pressure and migraine headache. In 1943 a Swiss chemist, Albert Hoffman, stricken with dizziness and hallucinations in his laboratory, found himself the first to have prepared LSD.

From the peyote cactus of the Rio Grande region comes mescaline. The plant's bitter-tasting "buttons," or fruit, when eaten or brewed into a tea, induce colorful visions—and are used for this purpose in strange religious rites of some American Indians.

"Divine mushrooms" of Mexico provide the newest of the hallucination drugs, called psilocybin. In 1955 a New York banker and explorer, R. Gordon Wasson, tracked down legends of wondrous mushrooms to a remote Mexican town—where he found them, growing wild, and participated in native rites of eating them. He had exquisitely colored, vividly detailed visions of landscapes, seascapes, mythological beasts. New to science, the mushrooms were brought back and successfully grown in Europe. Recently their active principle, psilocybin, was isolated by Dr. Hoffman, the discoverer of LSD. Psilocybin has not been mentioned as a military psychochemical, but its remarkable chemical similarity to LSD raises speculation as to whether it might serve that purpose.

As to the sources of its unnamed "on-the-floor" incapacitating agents, the Chemical Corps offers some guarded hints. Of the chemical that limply paralyzed dogs, Col. Lindsey says: "The drug has appeared in the medical literature as an experimental item, a pain-relieving agent. The compound is about 1,000 times more potent than the best pain reliever

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● Build car around our top quality surplus gear reduction battery motor. Govt. surplus motor operates from 12-volt storage battery. Use single motor or two motors (one on each wheel.) Simple to construct. Haul one or two adults. Motor gear ratio 1-100. Output shaft speed 100 RPM. Motor reverses instantly.

● Experts say electrics are coming back. Get in on this fine buy! Govt. cost over $300. SALE..... **$22.70 FOB**

POWER PLANTS

● Amazing buys in DeLuxe Govt. 115-v 60-c plants. Large selection. Write for descriptive catalog. All F.O.B.

● 1000-W ... **$169.75**
● 3000-W ... **289.50**
● 5000-W ... **$25.00**
● 7500-W ... **498.50**
● 3000-W (DC-115-v) .. **169.50**

Get Free Catalog.

AIR COMPRESSOR BARGAINS

● For painting, cleaning, tires, termites. Assemble own outfit.

● **Item #450.** Deluxe Kit. Compressor tank, gauge, regulator, paint gun, relief valve, fittings, hose, instructions. List $52. **$43.91 FOB** SALE.....

● Air Components. Compressor 1-cyl. **$19.35.** Air tank **$10.90,** Regulator **$3.95** Pop-off **$1.95.** Press. Gauge **$1.89.** Finest Paint Gun **$11.50.** Auto Switch **$4.75.**

Automatic

REMOTE CONTROL SWITCH

● **Item #738.** Amazing telephone automatic switch. Complete with dial and bank. Dial any number. Use for experimental remote control, telephone system, etc. Govt. cost over $100. SALE ..... **$14.21 FOB**

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● **Item #1315.** Govt 86-to-1 ratio heavy duty ball bearing reducer. Input shaft 3/8" dia. Output 1" dia. Wt. 14 lbs. Govt cost $137.50.

● Hand winch, 1000 lb. **8.25**
● Hand winch, 2000 lb. dual ratio 3-1, 9-1. A buy **28.95**
● Hand hoist, 2000 lb. **19.80**

All F.O.B.

SPECIAL OF THE MONTH!

LEADING MAKE ELECTRIC GRIDDLE

● **Item #124.** Large family size leading brand electric griddle. Designed for latest low cholesterol cooking. Excess grease drains off. Large enough for family of 6.

● Heavy cast aluminum with long life imbedded element. Automatic dial temperature control. ● One of our better bargains. Money back if not fully satisfied. Complete with cord. Operates on 115-v. 1200-w. Wt. 8½ lbs. Adv. price $21.95. SALE..... **$11.88** (Include enough for postg. to your town.)

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● Fish and worm shocker..... **$ 1.89**
● 200-Amp Welding generator..... **18.95**
● Pressure Air Tank (9" x 13") **3.45**
● Hydraulic Control Valve..... **9.95**
● 12-v DC Robot Control Motor.... **8.95**
● 115-volt AC Control relay..... **1.19**
● Old Fashioned Magnito Wall Phones **7.95**
● $2,000 Aircraft Gyroscopes—A buy **12.91**
● 6 x 1.50 Rubber Tired Wheels.... **.81**

6 or 12-V STORAGE BATTERY WINCH

● **Item #311.** Powerful fully reversible ball-bearing gear reduction winch. 1000-2000 lb. pull. Use on 6 or 12-v battery. Holds 40' of 1/4" cable. For trucks, docks, boats. Govt. cost $260. Sale ..... **$46.71 FOB**

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Savings to 80%. Build loaders, diggers, presses, etc. All brand new.

● Control Valve, 1 or 2 way.. **$18.00** Ppd.
● Tractor Pump 1000 psi .... **45.50** Ppd.
● 12-v Motor & Pump 1000 psi **16.95** FOB
● 2-Way cyl. 2½" bore, 9" str **12.95** FOB
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Many other types, sizes, items.

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Electronics, Power Tools, Binoculars, Hydraulics, Power Plants, Air Compressors and thousands of other items.

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No. S-710 (Wt. 53 oz.) Has pull of 225 lbs. on steel block....$18.00
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No. S-102 Pocket Magnet. 5 lb. pull. 2 for....$ 1.50
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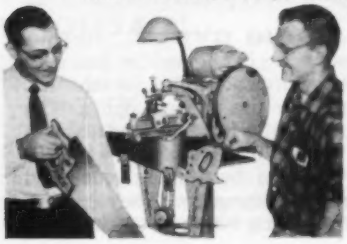
Make from $3 to $6 an hour spare time or start a full time business with the



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Here is a steady repeat CASH business you can start at home. No experience is necessary to turn out perfect cutting saws. With the new Model 200 Foley Saw Filer you can file hand, band and both "combination" and cross-cut circular saws. Easy to operate—no eyestrain. You will find you can make from $3 to $6 an hour—$20 to $30 a week in spare time as a starter.

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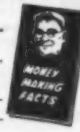

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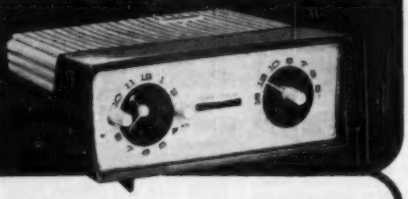

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Can "Loony Gas" Win Wars?

available to medical science today." Evidently its bad habit of causing paralysis, too, is the reason it hasn't made headlines.

This was one of about 400 compounds a month that drug and pharmaceutical houses are forwarding to the Chemical Corps, it was revealed, to see if they may be of military use. "The characteristics we are looking for, in these agents," says Gen. Stubbs, "are in general exactly opposite to what the pharmaceutical firms want in drugs—that is, the undesirable side effects."

What about policy? The U. S. has announced that we will use war gases only if they are used against us. This policy has had in mind the ones that kill, poison, and blister: chlorine, phosgene, mustard gas, and the far-more-lethal nerve gases that now have practically outmoded the others. Unjustly it seems to put the new psychochemicals in the same bracket.

Chemical Corps spokesmen hope for an early revision of this policy, to recognize that psychochemicals are the most humane of all weapons, and give a commander free rein to use them. END

SNOW-GOING CYCLE. Reider Berg, shown here in the saddle, has converted his motorcycle into a vehicle that isn't stopped by the deepest drifts. The Norwegian inventor has mounted a ski on the front wheel. In place of one wheel in the back, he uses two on an elongated axle driven by a sprocket. They are enclosed with leading idlers in tracks.

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MAKE EXTRA PROFITS!

Set 400 teeth per minute on hand or band saws, 4 to 16 point, with the BeMaCo Automatic Saw Set. Fast, accurate, true **hammer-anvil action** sets teeth uniformly, eliminates tooth breakage. Used profitably by saw shops and manufacturers everywhere. Every machine positively guaranteed!

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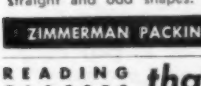

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SAVE UP TO 85% AT PALLEY'S

WINTER COAT

Of heavy drill coated with special plastic to make it waterproof. Lined with soft, warm sheepskin fleece. Has double breasted front with four button closure. Two slash pockets and two large flap pockets. Sizes 42 thru 46. . . . . 17.88

U.S. ARMY SURPLUS PARKA

with DETACHABLE INNER LINER — Used but RECONDITIONED

A fine Government Surplus Parka with an attached hood. Made of extra sturdy and closely woven Army Twill — it's water repellent and wind resistant. Has 3/4 length zipper front closure with a button down storm flap covering it. Removable inner liner is soft, warm pile. Body has two extra large side pockets. Color: O.D. Sizes: Small and Medium 14.88

SPECIAL SKI PARKA

Of white, water resistant twill. Slip-over style. Has drawstrings at neck and on hood for snug fit. 2 slash openings allow access to clothes underneath. Two sizes: Small and Medium. . 3.95

ARMY MUMMY SLEEP BAG

Just released by U.S. Government. Filled with 40% Down — 60% Fowl feathers. Full length zip. Cleaned and Reconditioned. 12.95

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Of heavy duty herringbone twill. Has belted waist and button front. Four large pockets. Cleaned and reconditioned like new. O.D. color. Sizes: small and large. . . . . Only 3.88

NEW SIGNAL CORPS TENT

Ideal for ice fishing, duck-hunting, etc. Of heavy weatherproof rubberized duck. The entrance has a full zipper closure. Vent at side takes heater or fan. Stitched-in floor and 3-piece poles included. Size: 5 ft. x 5 ft. x 5-1/2 ft. high 12.95

U.S. ARMY MUKLUKS

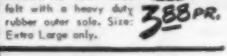
Keep your feet warm in the coldest weather. Made of waterproof canvas with a felt inner sole. Has drawstrings at the top, instep and ankle for a snug fit. Sizes are Small, Med., Large. $1.69 PR.

ARMY SURPLUS WINTER BOOTS

Uppers are heavy grade white felt with sturdy canvas cuff trimmed in white leather with straps and buckles. The midsole is extra thick felt with a heavy duty rubber outer sole. Size: Extra Large only. 3.88 PR.

STRATOPOWER HYDRAULIC PUMP AND MOTOR

Designed for intermittent use with pressure rating of 1500 PSI. Capacity 2.4 GPM. Motor operates at 26 V. DC, 80 amps, 1350 RPM. Ports — Inlet 3/4" AN; Outlet 3/8" AN. . . . . Catalog No. H-HPU-16 ONLY 22.50



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1500PSI hydraulic cylinder with 11" long rack. Double action type. Bore 1½" — Stroke 7½" — Shaft 11/16" — Length with rack 23". Catalog No. H-98 7.75

TYPE M-7

1-POWER ARMY RIFLESCOPE

Special SURPLUS CLOSE-OUT!

No magnifying power but gives clearer brighter image than with unaided eye. Has cross hair reticle. Field of view is 60 ft. at 100 yds. Length 8-7/8", eye-piece diam. 1", tube diam. 7/8", 13 ounces in weight. Eye relief — 4.384". Reticle not adjustable from outside of scope. Cost Gov't over $65.00. Used, good cond. No mounts. 4.95

FISHERMEN—HUNTERS—SPORTS FANS

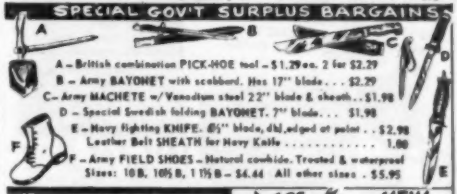
Keep Your Hands Warm WITH THIS

POCKET HAND WARMER

Gives comforting flameless heat for 16 to 24 hours without refilling or relighting. ABSOLUTELY SAFE! Burns white gas, benzine or lighter fluid for fuel. Heat element is completely metal enclosed — cannot burn or spill. Can be carried in hand or pocket. Ideal for Hunter, or Sports Fan. 1.98

Refill Elements for above. 2 for 89¢

SPECIAL GOV'T SURPLUS BARGAINS



A — British combination PICK-HOE tool — $1.29ea. 2 for $2.29
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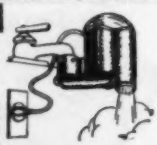
700 Watt Light Plant PUSH BUTTON START

115 v. 60 cyc. AC. Powered by a rugged 2.2 HP, easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. $275.... **$143.50**

1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output..... **$199.50**

ELECTRONIC BRAIN Now Available On All Our Plants Up To 100,000 Watts! Allows plant to saunter along at a thrifty idle till electricity is called for. Then instantly . . . automatically, plant comes up to full speed with a steady 115 volts of power. When demand stops, the BRAIN returns plant back to that same thrifty idle. Saves gas, doubles engine life! If BRAIN desired, specify & add 3 lb. and $35 to plant price.

FAUCET WATER HEATER



Instant hot water for just pennies—You just slip MASTER MECHANIC'S new Faucet Water Heater over any faucet—plug it in a wall outlet, and you've got steaming hot water instantly for dishes, shaving, washing baby's bottle, etc. Simple and safe—operates on ordinary 110 v. house current—costs only 2½ cents per hour for hot water. Ideal for homes, shops, cabins, trailers, etc. Easily regulated from lukewarm to full hot. *Fully guaranteed.* (Item 408) Wt. 2 lbs. **$4.95**

HEAVY DUTY D-C ARC WELDER

with mounting flange (Item 38)

Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to ¾" plate using ¼" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm, with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor and triple V belt or flat pulley. You can pay more but you can't buy a better welder. Wt. 110 lbs. $400.00 value..... **$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at... **$10.50**

Send 10c for 100 page Catalog-FREE with order. Prices f.o.b. factory—Send check or M.O

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No experience needed!
Use on iron, steel, bronze, brass, aluminum, other metals

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Low down payment. Pay-as-you-weld. Write for details. Literature on larger welders on request.

Professional type welder for home, shop, farm, industrial use. Build, straighten, bend, repair auto bodies, fenders, lawn mowers, wrought iron furniture, railings, fences, farm equipment. Anything metal. Save money—earn money in spare time. Operates on properly wired 110 AC line. Simple instructions included. Complete with helmet, electrode holders, arc torch, flux, solder, rods, cables. Act now! Order from this ad on 10 day money-back trial. 1 year guarantee.

DYNAMIC WELDER CO. 1808 SOUTH FEDERAL STREET Dept. D3-A, CHICAGO 16, ILL.

Russian Snow Cats to Prowl Antarctic

[*Continued from page 91*]

the tractors. Designers made them each a full meter (39 inches) wide to allow an even distribution of weight over as wide an area as possible. Then they laced them with snow grips—meter-wide metal frames with vertical ribs to dig into the granular snow.

Seven pairs of rubber-clad rollers, bearing on the tracks, support the hollow, sealed chassis through torsion bars.

Up front the designers put a 520-hp., 12-cylinder diesel engine, and added a supercharger to increase horsepower to 800-1,000. Supercharging will be especially important at the high altitudes—up to 12,000 feet—at which the vehicle may travel.

Tucked in beside the engine are a five-speed gearbox, steering mechanisms, two generators (yielding 13 kw.), and storage batteries.

In the rear are two heaters that draw in cold air, heat it, and send it through ducts in the cabin walls to nozzle openings in the cabin itself.

Also in the rear is a "self-recovery" winch. With its 100-foot steel cable, the winch can be used two ways: to facilitate hauling a 70-ton trailer, or to pull the tractor out of an icy crevasse if necessary.

Finally, engineers turned their attention to the cabin itself. Also hermetically sealed, it is 28 feet long, 12 feet wide, and seven feet high.

The control compartment, with room for driver and navigator, sits over the power section at the front end. Gear includes two radio receivers, a transmitter, a radio direction-finder, and radio and magnetic compasses. A transparent dome over the navigator's head houses an astrocompass.

Beyond the control compartment, there's a bunk room that sleeps six, a work room, a kitchen, a washroom and toilet, an apparatus room, a drying room, and a small foyer.

The designers would have liked to make the tractor amphibious. They couldn't. But they maintain it won't sink if it goes through the ice, because it's watertight; water can't rise above the floor of the cabin. Theoretically, the spinning tracks will tread water while the winch is made ready to get it back on the ice again.—*Joan Steen.*

FOR 1960

More aluminum, lighter weight, better performance, beautiful styling. Still World's Lowest Priced Car. Drive it for 75¢ a week. Rider Agents Wanted. If no dealer near you send 25¢ for 32 page picture book, full details, dealer price, or send $1 (refunded first order) for this and Service Manual plus Repair Manual and 15 5x7 photos of car and factory.

MIDGET MOTORS CORPORATION, Athens 2, Ohio

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AMERICAN CREDO

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.22 Cal NEW 7 SHOT REPEATER AUTOMATIC. The skilled hands of the German gunsmith is responsible for this .22 Caliber 7 shot repeater automatic with self-ejecting empty shells. Just 4 inches long, fits easily into pocket or purse. Ideal for sporting events. Stage use (Not available to Calif. residents). Not a lethal weapon. Money back guarantee. Comes for $6.95 from **Best Values Co., Dept. F-97, 403 Market St., Newark, New Jersey.**

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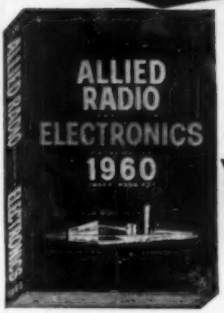

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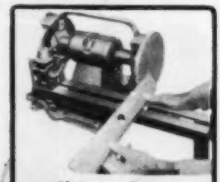

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UNITED INDUSTRIES, Inc.
227 Yates Ave., Beloit, Wisc.

A Deep-Water Thing-Finder

[*Continued from page 158*]

intensive probing of small areas. Cut locking grooves in their ends as shown.

The gasket that seals the two caps can be cut from sheet fiber or from the cover of a spiral-bound notebook. Hone one point of your dividers to a chisel edge to cut circles in the fiber.

Wiring and waterproofing. Install the compression fitting in the top cap and pass rubber-covered wire through it. Vacuum-cleaner cord is good; it is flexible, round, and about 1/4″ in diameter. You'll rarely need more than 75 feet. Strip off about 6″ of the rubber covering and knot the two wires so they can't pull out of the compression fitting. Cover a rubber band with flexible gasket compound and wrap it around the wire just above the compression fitting. When you tighten the compression nut, this seal will be watertight.

Solder the two leads to the microphone, using a brief touch with a hot iron to avoid damage by overheating. Place the fiber gasket on the top cap and cement the microphone in the bottom cap. Cover the threads and gasket with gasket compound and tighten the case halves together. If you twist the lower case to the left about six turns, the wires inside will unwind when the case is assembled.

Put gasket compound on the threads of the antenna cone and screw it in place.

For the three volts required to operate the finder, you can easily adapt a flashlight by soldering wires to its contacts, or wire two No. 6 dry cells in series.

Using the thing-finder. To search systematically, you'll need a rowboat with a man to row as you work at the stern.

Lower the finder until you hear the antennas strike the bottom, then raise it slightly for them to clear. Move the boat slowly across the search area and maintain the search course by triangulating your position by shore points. A basketful of small floats, sinkers, and fishline will help buoy off the search area.

When you hear the antennas hit something, fish the finder up, down and sideways, making an effort to outline the shape of the sunken object. When the lost equipment has been located and marked, you can recover it with a grapnel, oyster tongs, a rake, or by diving.

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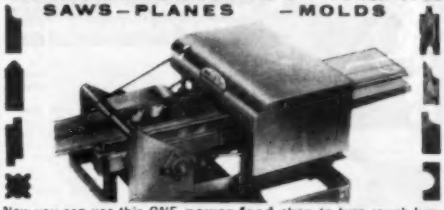

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Space-Age Crystal Set

[Continued from page 171]

nut. Install the phone jack, and the radio is ready for wiring.

Use stranded hookup wire; it can take the flexing imposed by opening and closing the case.

Pitfalls for amateurs. The wiring shown in the drawing is straightforward and follows the circuit schematic. If you're familiar with electronic wiring, you'll probably find some short cuts. If you're a beginner, stick to the diagram. If you run into trouble, don't hesitate to remove the parts, do the soldering outside, and then replace them.

Use care when soldering the diode and transistor—excess heat will damage them. Sidestep part of the risk by soldering to the lugs of a transistor socket, then slipping the transistor in place. You'll have to clip the transistor's leads to make it fit.

Bend the diode's leads to fit before soldering it between the base of the transistor and the loopstick.

Close the case when you've finished soldering, plug in the earphone, and listen. There's no on-off switch: The battery never wears out.

You should pick up stations at their proper position on the dial as indicated by the point of the battery or a dot on the lid. If the calibration is too far off, make a hole in the end of the case in line with the slotted screw on the loopstick. Turning this screw one way or the other will shift the stations enough to align the dial.

Outdoors, you'll find you don't have to point the Solar Mite at the sun—there is plenty of incident light for satisfactory operation. Keep the whip upright for maximum volume.

For stronger signals. Touching the silver center of the tuning dial may give you a stronger signal, since your body acts as a ground. Also try wetting your finger before touching the dial.

While the Solar Mite will play on the whip antenna, for peak performance connect the whip to your TV antenna. If you don't have an outdoor antenna of any kind, clip a lead on the finger stop of a telephone dial. You'll find that the radio works well enough to bring in a strong station even in the dark—acting as a crystal set without the help of its transistor amplifier.

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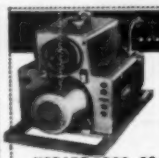

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Safety: An Expert Takes a Critical Look at the '60 Cars

[Continued from page 121]

Two specific indictments still pend against Detroit, nevertheless, in the realm of the survivable accident. The first is its campaign of silence against the seat belt; the second, its widespread neglect of the hazards of the front seat back.

The feeling seems to be that if you don't notice the seat belt, it will go away. This is just what it is doing. Ford's dealer installations of this safeguard have dropped from a peak of seven percent of car sales to around three percent. Worse, surveys show a disheartening decline in the use of belts by those who had the sense to invest in them.

This simply proves that the seat belt has to be sold, just as does life insurance, fire extinguishers, and polio shots. The fact that people don't buy these things without pressure is no argument for dropping them. People didn't buy four-wheel brakes, either, until they were sold to them—by Bendix, incidentally, not by the automobile manufacturers, who originally gave them the same silent treatment now accorded belts.

Likewise, most customers in the early days refused to pay extra for safety glass —until it was made mandatory by law. This will hardly happen to the seat belt: You can legislate it into the car, but you can't legislate it around a guy's middle! So it has to be sold. And this should be done on an industry-wide, noncompetitive basis as a principle, not a product; as a habit, not as a piece of merchandise.

Evidence for the second indictment was clearly presented even before 1960 designs were frozen, in a paper published in *Surgery* for September, 1957, by Braunstein, Moore, and Wade. This study showed that of 2,000 injury-producing accidents analyzed, the most important single factor of car structure was the steering assembly, heading the list with 29.4 percent of the casualties. This was pretty obvious, and something constructive has been done about it with the deep-dish wheel.

A major source of trouble about which very little has been done, however, is the back of the front seat. In the study this factor is divided into two categories:

Backrest (top portion) 11.0%
Backrest (lower portion) 15.1%

So this single unit accounts for 26 percent of injuries, ranking second only to the steering assembly in frequency. In severity of injuries, it ranks behind ejection but about equal to the instrument panel.

There is food for thought here, since the seat behind the steering assembly is always occupied, whereas the back seat is often empty. While some slight improvement in rear-seat foot room is evident in 1960, especially in the Chrysler lines, which needed it most, we still have a long way to go. The same applies to padding the front seat back.

One phase of the safety problem in which a glimmer of hope does show is the matter of rear vision. Glass area in modern cars has reached the point of diminishing return, and yet the treacherous blind spot still remains in both rear quarters—a grave risk in our superhighway and expressway era. In the past we have prayed in these columns for some adaptation of the periscope principle. Now American Optical Company has licked the problems involved and is offering such a device to Detroit as original equipment (it must be built into the roof, not added later). So far there have been no takers, but sooner or later somebody among the manufacturers will wake up.

Detroit die-hard attitudes haven't changed much. Safety is not discussed openly except in double-talk. One company has issued a list of "138 Safety Features in the 1960 Models"; if the author had only added wheels, tires, and doors, he would have had 141!

Last year we mentioned the handwriting on the wall; this year we can read the first paragraph of the message in the form of the Roberts Bill, which has passed the House and is expected to be okayed by the Senate. But this simply provides that the government may buy only such makes of cars as meet specific safety requirements established by the U. S. Bureau of Standards. A small step, it will still have a salutary effect.

Eventually, through government "interference," the motorist may enjoy the same measure of safeguard against the survivable highway accident that he has so long received through meat inspection, food and drug supervision, and aircraft and marine safety standards.

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[*Continued from page 121*]

Two specific indictments still pend against Detroit, nevertheless, in the realm of the survivable accident. The first is its campaign of silence against the seat belt; the second, its widespread neglect of the hazards of the front seat back.

The feeling seems to be that if you don't notice the seat belt, it will go away. This is just what it is doing. Ford's dealer installations of this safeguard have dropped from a peak of seven percent of car sales to around three percent. Worse, surveys show a disheartening decline in the use of belts by those who had the sense to invest in them.

This simply proves that the seat belt has to be sold, just as does life insurance, fire extinguishers, and polio shots. The fact that people don't buy these things without pressure is no argument for dropping them. People didn't buy four-wheel brakes, either, until they were sold to them—by Bendix, incidentally, not by the automobile manufacturers, who originally gave them the same silent treatment now accorded belts.

Likewise, most customers in the early days refused to pay extra for safety glass —until it was made mandatory by law. This will hardly happen to the seat belt: You can legislate it into the car, but you can't legislate it around a guy's middle! So it has to be sold. And this should be done on an industry-wide, noncompetitive basis as a principle, not a product; as a habit, not as a piece of merchandise.

Evidence for the second indictment was clearly presented even before 1960 designs were frozen, in a paper published in *Surgery* for September, 1957, by Braunstein, Moore, and Wade. This study showed that of 2,000 injury-producing accidents analyzed, the most important single factor of car structure was the steering assembly, heading the list with 29.4 percent of the casualties. This was pretty obvious, and something constructive has been done about it with the deep-dish wheel.

A major source of trouble about which very little has been done, however, is the back of the front seat. In the study this factor is divided into two categories:

Backrest (top portion) 11.0%
Backrest (lower portion) 15.1%

So this single unit accounts for 26 percent of injuries, ranking second only to the steering assembly in frequency. In severity of injuries, it ranks behind ejection but about equal to the instrument panel.

There is food for thought here, since the seat behind the steering assembly is always occupied, whereas the back seat is often empty. While some slight improvement in rear-seat foot room is evident in 1960, especially in the Chrysler lines, which needed it most, we still have a long way to go. The same applies to padding the front seat back.

One phase of the safety problem in which a glimmer of hope does show is the matter of rear vision. Glass area in modern cars has reached the point of diminishing return, and yet the treacherous blind spot still remains in both rear quarters—a grave risk in our superhighway and expressway era. In the past we have prayed in these columns for some adaptation of the periscope principle. Now American Optical Company has licked the problems involved and is offering such a device to Detroit as original equipment (it must be built into the roof, not added later). So far there have been no takers, but sooner or later somebody among the manufacturers will wake up.

Detroit die-hard attitudes haven't changed much. Safety is not discussed openly except in double-talk. One company has issued a list of "138 Safety Features in the 1960 Models"; if the author had only added wheels, tires, and doors, he would have had 141!

Last year we mentioned the handwriting on the wall; this year we can read the first paragraph of the message in the form of the Roberts Bill, which has passed the House and is expected to be okayed by the Senate. But this simply provides that the government may buy only such makes of cars as meet specific safety requirements established by the U. S. Bureau of Standards. A small step, it will still have a salutary effect.

Eventually, through government "interference," the motorist may enjoy the same measure of safeguard against the survivable highway accident that he has so long received through meat inspection, food and drug supervision, and aircraft and marine safety standards.

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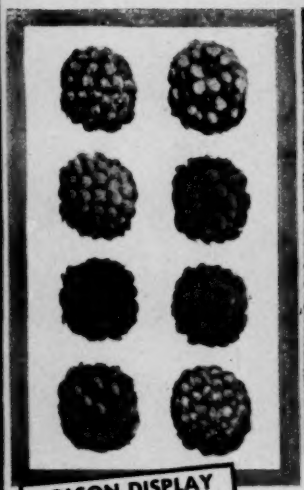

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